INDO-US WORKSHOP ON NANOTECHNOLOGY: APPLICATIONS AND IMPLICATIONS

November 10-12, 2009

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY

(Council of Scientific & Industrial Research)

Tarnaka, Hyderabad - 500 607, A.P., India

CSP-091027

The Organizing Committee - iuwontaai - 2009
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Indian Institute of Chemical Technology
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14. ABSTRACT

This is the proceedings of a conference basic and applied research on nanotechnology with a focus on the toxicological aspects of nanomaterials.

15. SUBJECT TERMS

Nanomaterial Synthesis and Characterization,
Magneto-optical imaging , Nanomaterial Safety and Toxicology

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Director & Staff of IICT

WELCOME

THE DELEGATES OF
INDO – US WORKSHOP ON
NANOTECHNOLOGY APPLICATIONS
AND IMPLICATIONS – 2009

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY, (IICT)
HYDERABAD- 500 607

Indian Institute of Chemical Technology, Hyderabad is a premier R&D Institute in India. IICT is a multi-disciplinary laboratory and pursuing R & D in Chemical technology, Process design and Detail engineering service areas.

IICT provides technologies (Lab/bench/pilot plant scale) for

- ❑ Agrochemicals/pheromone chemicals
- ❑ Drugs and pharmaceuticals
- ❑ Lipid science and technology
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IICT provides knowledge based services for

- ❑ Physiochemical and thermal characterization of heterogeneous and homogeneous catalysts
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- ❑ Pilot plant facilities for up scaling of processes
- ❑ Process simulation,

For further details contact:
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Biology Division
Indian Institute of Chemical Technology

Biology Division is a centre for excellence to provide high quality of basic and applied research in Bioinformatics, Entomology, Toxicology and Rural Development with state of art facilitates.

VISION AND GOALS : Bioinformatics , Rural development , Entomology & Toxicology

CORE COMPETENCE AND ACTIVITIES

- **Information Technology for Integrated vector Management**
- **Information technology for rural development**
- **Bio control & Bio-evaluation of new molecules and natural product extracts employing entomological and toxicological & methods**
- **Eco toxicological studies**
- **Biomarkers as biological indicators of xenobiotic exposure**
- **Development of alternate methods for pest control**
- **Studies on insect plant interactions for development of better and safer pest control**
- **Offering advanced course in Bioinformatics jointly with CDAC & JNTU. For details see the following URL www.iictindia.org /adbi/index.htm**

CURRENT RESEARCH AREAS

- **Bioinformatics and computational biology**
- **Environmental management for the integrated vector control & vector born diseases**
- **Medical informatics**
- **Rural development through sericulture, plant tissue culture etc.**
- **Marine natural product evaluation**
- **Toxicological evaluations of test samples**
- **Kairomones for IPM**

SERVICES

- **Biology Division is recognized by Govt. India to under take the following test**
- **Insecticidal activity (on mosquitoes, agricultural pests etc.)**
- **Bio-efficacy and persistent studies of toxicant on different surfaces**
- **Anti-bacterial &anti-fungal activity**
- **Termite testing**
- **Regulatory toxicity studies (both short term & long term) as per Gaitonde protocol and OECD guidelines**

CENTERS

- **EMCB-ENVIS Node on bioinformatics –vector control (World Bank –assisted programme through Ministry Environment & Forest, Government of India, www.envisiict.org**
- **Biotechnology Information System (BTIS) A National Bioinformatics network Program on vector Born disease (Dept. Biotechnology, Govt. of India)**

PRODUCTS AVAILABLE

- Fililariasis DBMS 1.1(database management system)for integrated control of Bancroftian Fililariasis of East & West Godavari district of Andhra Pradesh
- An integrated forecasting system for the control of malaria in Mizoram & Sikkim
- ANOMAS 1.1(Rapid Identification Mosquito species)
- SAMADHAN KENDRA (IT for rural development)
- IGR PRODUCTS
- Alkylxanthates as newer IGR on agricultural pests (3 nos)

INFRASTRUCTURE

- Modern insectary
- Mammalian toxicology lab
- Microbiology lab
- Tissue culture lab
- Glass house
- Animal house as per GLP norms
- Bioinformatics lab with super computer PARAM 10000 access
- UV VIS spectrophotometer
- Video microscope
- Paraffin embedder
- Slide strainer
- Tissue processor
- Microtome
- Liquid scintillation counter
- Climatic chamber
- Autoclave sterilizer
- Laminar flow unit Ultra centrifuge
- High-speed centrifuge
- Inhalation chamber
- Deep freezer(-95 degrees)
- Ethovision
- CO_2 incubator
- Florescent microscope

Contact person (Technical)

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Head Biology, Indian Institute of Chemical Technology, (IICT),
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ACKNOWLEDGEMENTS

The organizers express their sincere thanks to Dr. J. S. Yadav, Director for agreeing to host this Indo-US workshop on Nanotechnology: Applications and Implications at Indian Institute of Chemical Technology, Hyderabad, India. We are also thankful for his encouragement, support and help. The organizing committee wishes to put on record their sincere appreciation for the generous support provided by the Council of Scientific and Industrial Research, India; Department of Biotechnology, India; Department of Science and Technology, India.

It is with a deep sense of gratitude that we wish to thank our US sponsor, Tuskegee University, Alabama, USA.

We wish to thank US Army International Technology Center – Pacific and Airforce Office of Scientific Research, Asian Office of Aerospace Research and Development for their contribution to the success of this conference. Disclaimer AFOSR / AOARD and ITC-PAC support is not intended to express or imply endorsement by the US Federal government.

We are indeed indebted to American Elements, Academics and Periodicals Department, USA, Indian Nanoscience Society, India, Prasad and Company (Project works Limited), Hyderabad; Maharaja Co.op, Urban Bank Ltd., Visakhapatnam, Ashwani Chemicals and Instruments, Hyderabad; A. P. Para Medical Board, Hyderabad; Radha Krishna Pearls and Gems, Hyderabad; Sangeet Sagar, Hyderabad; Hi- Hurbs Pharmaceutical, Hyderabad, Lab India Instruments Pvt. Ltd. Thane, SISCO Research Laboratories Pvt. Ltd., Mumbai and Alliance Tecknologies, Bangalore for their support.

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Director, IICT (CSIR).

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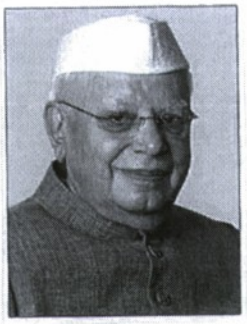


RAJ BHAVAN
HYDERABAD-500 041

31ST October, 2009

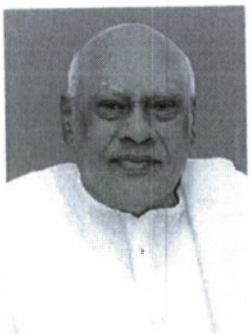
MESSAGE

The Governor of Andhra Pradesh is pleased to convey his best wishes for the success of INDO-US WORKSHOP ON NANOTECHNOLOGY APPLICATION AND IMPLICATION to be held from 10th -12th November, 2009, at INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY, HYDERABAD.

Press Secretary to Governor

31-10

K. ROSAIAH



HYDERABAD

30-10-2009

CHIEF MINISTER
ANDHRA PRADESH

MESSAGE

I am delighted to learn that the Indo-US Workshop on Nanotechnology: applications and implications will be held from 10th to 12th November, 2009 and that the workshop will be attended by scientists from USA and India.

There has been much debate on the future implications of Nanotechnology. Nanotechnology has the potential to create many new materials and devices with a vast range of applications such as in medicine, electronics and energy production. On the other hand, nanotechnology raises many of the same issues as with any introduction of new technology, including concerns about the toxicity and environmental impact of nanomaterials, and their potential effects on global economics, as well as other apprehensions.

As this workshop will bring together a large number of Scientists from National and International Organisations, I hope it would deliberate on the implications of this technology and the deliberations will be useful in extending the state of knowledge on the subject.

I wish the workshop a grand success.

K. Rosaiah

(K.ROSAIAH)

Dr.Paramjit Grover,
Organising Secretary,
Indo-US Workshop on Nanotechnology: Applications & Implications,
Indian Institute of Chemical Technology,
Uppal Road,
Hyderabad 500 007.

Dr. PEDDIREDDI RAMACHANDRA REDDY,
M.A., Ph.d
Minister for Forests, Environment, Science & Technology

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Banjara Hills, Hyderabad.

30.10.2009

MESSAGE

I am very much pleased to know that the Indian Institute of Chemical Technology is conducting an "Indo – US workshop on Nanotechnology on 10th -12th November, 2009. Conducting of this workshop at this juncture is very appropriate as it will provide a golden opportunity to IICT Scientists as well as others working in the field of Nanotechnology to interact with international experts in this area.

I wish all success of this workshop.

(Dr P. RAMACHANDRA REDDY) 30/10

D. SRIDHAR BABU
MINISTER FOR HIGHER EDUCATION &
NRI AFFAIRS (AP)
GOVERNMENT OF ANDHRA PRADESH.

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040-23453241
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No. 27, Ministers Quarters,
Road No. 12, Banjara Hills,
Hyderabad.

MESSAGE

I am extremely happy to know that Indian Institute of Chemical Technology, Hyderabad, is organizing an Indo – US Workshop on Nanotechnology: Application and Implication from 10th to 12th November, 2009.

It is al known fact that Nanotechnology has the potential to create new materials and devices with a vast range of application such as in Medicine, Electronics, Energy Production etc. However, as is in the case of any introduction of a new technology, it raises many of the same issues, whlch includes concerns about the toxicity and environmental impact of Nanomaterials and their potential effects on global economics. There is an urgent need for a debate among the concerned groups in regard to the concerns raised.

I wish the participants in the workshop all the very best and hope that during the deliberations, the concerns raised due to the introduction of the new technology would be addressed.

(D. SRIDHAR BABU)

Prof. T. Tirupati Rao
Vice - Chancellor

[Re-Accredited by NAAC with 'A' Grade]

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Date: October 31, 2009

MESSAGE

I am happy to know that Indian Institute of Technology, Hyderabad is organizing an Indo-US workshop on Nanotechnology: Application and Implication from 10th to 12th November, 2009 at IICT, Hyderabad.

I deeply appreciate the initiative in organizing this event. Nano Materials are an emerging area in the knowledge era. International cooperation for furtherance of research and advancement of knowledge in this frontier area will be of immense benefit to the scientific community.

I wish the workshop all success.

T. Tirupati Rao

PROF.T.TIRUPATI RAO

भारतीय रासायनिक प्रौद्योगिकी संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)
Indian Institute of Chemical Technology
(Council of Scientific & Industrial Research)
हैदराबाद - 500 007, भारत. Hyderabad - 500 007, INDIA

Dr. J S Yadav FNA, FTWAS
Director

डॉ. जे एस यादव एफ एन ए, एफ.टी.डब्ल्यू.ए.एस
निदेशक

MESSAGE

My warm welcome to all the delegates of IUWONTAAI-2009 to IICT. It is a matter of pride that IICT is the venue for hosting this Indo-US workshop on "Nanotechnology: Applications and Implications" during November10-12, 2009. It is indeed a great privilege for IICT to host this workshop with its outstanding facilities and competencies. I learnt that this workshop is the first if its kind to be organised by Biology Division of IICT in collaboration with Asian Office of Aerospaee Researeh and Development, USA. This initiative is an affirmation of the commonality of interests, where both the countries can derive synergistic benefits from each other's experience and expertise.

The intention in organizing this workshop was to draw various organizations and researchers involved in nanomaterial science and encourage mutual transfer of technology. I wish you all a very happy and pleasant stay at our City of Pearls and the City of Nizams, Hyderabad.

I wish this workshop all suceess.

Date: 2nd November, 2009

(J S YADAV)

Telephone : Off :+ 91 - 40 - 2719 3030 • 2719 3234 Res : 2719 3456 Fax : + 91 - 040 - 2716 0387 • 2716 0757
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Indian Nanoscience Society

(Registered under Act XXI of Societies Registration Act, 1860)

MESSAGE

It is with pleasure that the Indian Nanoscience Society is associated with Indian Institute of Chemical Technology, Hyderabad in organizing the **Indo-US Workshop on Nanotechnology: Applications and Implications.**

Nanotechnology has progressed globally and revolutionized the field consumer products commercially available in market. Since, safety data for nanomaterials are limited the implications of nanotechnology are very important and pertinent. This event shall attempt to bring together eminent national and international researchers on one platform to share their experiences in advancement of nano-science from technology to safety. The programme has been very carefully planned and deliberations during the workshop shall help to evolve strategies for creation of safety measures for nanomaterial exposure risk, which in turn shall be useful for regulatory bodies.

Indian Nanoscience Society wishes to convey its best wishes to the organizers for a successful workshop.

Alok Dhawan
Secretary

Mukul Das

Mukul Das
President

Secretariat

Dr. Alok Dhawan, Developmental Toxicology Division
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INDO- US WORKSHOP ON NANOTECHNOLOGY: APPLICATIONS AND IMPLICATIONS

10-12 November, 2009, HYDERABAD, INDIA

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Ms. C.B.Lakshmi
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Dr. Saber Hussain (USA)
Dr. Shaik Jeelani (USA)

I feel greatly honored to invite you all to the *Indo-US workshop on Nanotechnology: Applications and Implications* being organized by Indian Institute of Chemical Technology, Hyderabad in collaboration with the Asian Office of Acrospace Research and development, USA and Indian Nanoscience Society, India

Nanotechnology can perhaps be defined as the science of miniature things. It is the engineering of functional systems at the molecular scale with the projected ability to construct complete and high performance products from the bottom up. The focal theme of this workshop is to promote basic and applied research in the emerging field of nanotechnology with due focus on the toxicological aspects of these nano materials.

I am confident that this conference will bring together many senior experts, scientists, young researchers and students from India and all over the world. The organizing committee sincerely welcomes you all to participate in this event and hope it would fetch you rewards in scientific terms and memories in terms of our hospitality in the City of Nizams.

Paramjit Grover

Dr.(Ms).Paramjit Grover

IUWONTAAI-2009

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INDO-US WORKSHOP ON NANOTECHNOLOGY: APPLICATIONS AND IMPLICATIONS

Indian Institute of Chemical Technology, Hyderabad

November 10-12, 2009

PROGRAMME

November 10, 2009 **Venue: IICT, Auditorium**

09.00-10.00 am	Registration	
10.00-11.00	Inaugural Session	
10.00am	CSIR Song	
10.05am	Welcome Address	Dr.J.S. Yadav, Director, IICT, Hyderabad
10.15am	About the Workshop	Dr.U.S.N.Murty, Head, Biology Division, IICT, Hyderabad
10.25am	Inauguration of the workshop & Inaugural address	Prof.N.K.Ganguly, Distinguished Biotechnology Fellow & Advisor, Translational Health Science & Technology Institute, New Delhi
10.40am	Release of Souvenir	Dr. M. Saber Hussain, Applied Biotechnology Branch, Human Effectiveness Directorate, Air Force Research Laboratory, Wright-Patterson AFB, Dayton, OH, USA.
10.45am	Keynote Address	Dr.Vijaya Kumar Rangari, Research Assistant Professor, Center for Advanced Materials, Materials Science & Engineering, Tuskegee University, Tuskegee, AL36088, USA
10.55am	Vote of Thanks	Dr.Paramjit Grover Organizing Secretary
11.00am	High Tea	

November 10, 2009 Venue: IICT, Auditorium

INVITED LECTURES (11.30 AM to 1.30 PM)
Chairperson: Dr. V.K. Rangari, USA
IL-1: Dr. Mahesh V. Hosur. Center for Advanced Materials, Tuskegee University, Tuskegee, AL, USA. **Environmental Degradation Resistance of Fiber Reinforced Nanocomposites.**
IL-2: Dr. Alok Dhawan. Nanomaterial Toxicology Group, Indian Institute of Toxicology Research, Lucknow. **Nanomaterials Toxicology: An Art of Science.**
IL-3: Dr. Suash Deb. Dept. Of Computer Science & Engineering, C.V. Raman College of Engineering, Bhubaneswar. **Evolutionary Nanotchnology & Carbon Nanotubes: prospects & Challenges.**
IL-4: Dr. S.V. Manorama. IPC Division, IICT, Hyderabad India. **Adaptation of Inorganic Nanoparticles for applications in Biology.**
LUNCH (1.30 to 2.00 PM)
INVITED LECTURES 2.00 PM to 3.00 PM
Chairperson: Dr. Alok Dhawan
IL- 5: Dr. M. Saber Hussain. Air Force Research Laboratory, Wright Patterson AFB, Dayton, OH, USA. **Toxicity of Nanomaterials: Importance of Surface Modification.**
IL-6: Dr. S.N.Sharma. Electronic Materials Division, National Physical Laboratory, New Delhi. **Perspective of Colloidal Hybrid Organic-Inorganic Quantum Dot Composites.**
IL-7: Dr. N. Madhusudhana Rao. CCMB, Hyderabad, India. **Nanomaterials in Biosensing.**
Oral Paper Presentation 1: Nanomaterial Synthesis (3.00 PM to 6.00 PM)
Chairperson: Dr. Rohit Kumar Rana
OP-1: P. Khosla. Dept. Pharmacology & Toxicology, NIPER, SAS Nagar, Punjab. **A novel one pot green synthesis of stable silver nanoparticles using tannic acid as a reducing agent.**
OP-2: D.A.Mahuya. National Institute of Technology, Rourkela. **Reutilization of biological waste material: Preparation of porous HAP.**
OP-3: M. Alexander. Dept. of Inorganic Chemistry, University of Madras, Chennai. **Palladium Nanoparticles modified Titanium Dioxide Nanotube & Its Electrocatalytic Application in Hydrazine Oxidation.**
OP-4: P. Paulraj. Dept. of Inorganic Chemistry, University of Madras, Chennai. **Single Pot Synthesis of Cadmium Sulfide Nanowires by Thermal Decomposition of Cadmium Diethy Dithiocarbomate.**
OP-5: S. Parani. Dept. of Inorganic Chemistry, University of Madras, Chennai. **Synthesis of Manganese Doped Thiol Protected Zinc Sulfide Nanorods & Its application on Imaging of Cancer Cells**
OP-6: N. Sharma. Photonics India, Bangalore. **New Frontiers in Surface Characterization with Imaging Ellipsometry.**

TEA 4.00 PM
OP-7: D. Inbakandan. Centre for Ocean Research, Sathyabama University, Chennai. **Biosynthesis of Gold Nanoparticles Mediated by a Novel Marine Sponge Extract.**
OP-8: M. Ramulu, Design & Engineering Division, Indian Institute of Chemical Technology, Hyderabad. **Mechanical Behaviour of Nanomaterials Produced by Severe Plastic Deformation & Study Toward Industrial Applications.**
OP-9: M. R. Panigrahi. Dept. of Physics, National Institute of Technology, Rourkela, Orissa. **Measurement of void –species nanostructure of modified $BaTiO_3$ ceramics with FSDP related XRD.**
OP-10:D. Damodar. Organometallic Group, I&PC Division, Indian Institute of Chemical Technology, Hyderabad. **PANI/Fe3O4 Magnetite Nanocomposites: An Efficient & Reusable Catalyst for Synthesis of Diaryl Ethers**
OP-11: Shaik Firdoz. Center for Nanotechnology, Indian Institute of Technology, IIT Roorkee. **Nano biosensor for pesticide detection in water samples and Fruit juices**
OP-12: Shirley. Dept. of Microbiology, Gulbarga University, Gulbarga. **Role of Actinomycetes from Hutti Gold Mines and Other Novel Isolates for the Synthesis of Silver and Gold Nanoparticles.**
OP-13: R. Rajesh. Dept. of Botany, The Institute of Science, Mumbai. **Extracellular Sythesis of Gold and Silver Nanoparticles Using Dried Leaves of *Vitex negundo* Linn.**
OP-14: Dr. A. K. Gade. Dept. of Biotechnology, SGB, Amravati University, Amravati. **Biosynthesis of silver nanoparticles by using *Phoma herbarum* and their activity against human pathogenic bacteria.**
OP-15: Udbhav Ojha. Indian School of Mines University, Dhanbad. **Synthesis and Characterisation of Zinc Oxide based Nanofluids with stability, pH and viscosity relationships subject to heating and cooling cycles.**
OP-16: Ashwin Murugappan, Central Electrochemical Research Institute, Karaikudi. **Synthesis and applications of magnetic nano particles.**
OP-17: Himanshu Bhatia. University Institute of Engineering & Technology, Punjab University, Chandigarh, India. **Synthesis of Nano-Magnets in Magnetic Bacteria.**
Cultural Programme by Samaj Darpan & Hyderabad Arts & Cultural Association, Hyderabad in IICT Auditorium at 6.00 PM to 8.00 PM
DINNER at Diamond Jubilee Park, IICT Campus at 8.00 PM

November 11, 2009 Venue: IICT, Auditorium

INVITED LECTURES (9.00 AM to 11.00 AM)
Chairperson: **Dr. Mahesh V. Hosur, USA**
IL-8: Prof. Pallu Reddanna. School of Life Sciences, University of Hyderabad, Hyderabad. **Cyclooxygenase-2 as a Marker for evaluating inflammatory responses of metal nanoparticles.**
IL-9: Dr. Anil Kandalam. Associate Professor,Department of Physics, McNeese State University,Lake Charles, LA 70609, USA. **Probing the interaction of Nanostructures with Biological systems: A computational investigation.**
IL-10: Dr. Vijaya K. Rangari. Materials Science and Engineering, Center for Advanced Materials, Tuskegee University, Tuskegee, AL 36088. **Fabrication and characterizastion of high strength nanocomposite single fibers for multifunctional applications.**
IL-11:Dr. B.M. Reddy. IPC Division, IICT, Hyderabad. **Novel synthesis techniques and application of Nanostructured oxides.**
TEA 11.00 AM
Chairperson: Dr. I. Ahmad
IL-12: Dr. B. Dinesh Kumar. Food & Drug Toxicology Research Centre, NIN, Hyderabad. **Pre-clinical Evaluation of Nano particles.**
Oral Paper Presentation I1: Nanomaterial Toxicology (11.30 AM to 1.30 PM)
OP-18: M. Mahboob. Toxicology Unit, Biology Division, IICT, Hyderabad. **In Vivo Toxicological evaluation of silver nanomaterial.**
OP-19: K. Logaranjan. Dept. of Inorganic Chemistry, University of Madras, Chennai. **Biosynthesis of silver Nanoparticles using Phyllanthus Niruri extract and their application to study their anticancer activity (HEPG2) and antimicrobial activity.**
OP-20: M. Vibin. Dept. of Biochemistry, University of Kerala, Thiruvananthapuram. **Cytotoxicity and fluorescence studies of silica over coated CdSe Quantum Dots for bioimaging applications – A preliminary study.**
OP-21: V. Raji, Dept. of Biochemistry, University of Kerala, Thiruvananthapuram. **Biodistribution and toxicity evaluation of gold nanoparticles in Swiss Albino mice.**
OP-22: Manosij Ghosh. Centre of Advanced Study: Cell and Chromosome Research, Department of Botany, University of Calcutta, Calcutta. **Genotoxic effect of different sizes of nanosilver on human lymphocyte: a preliminary report.**
OP-23: A. Balasubramanyam. Toxicology Unit, Biology Division, IICT, Hyderabad. **Genotoxicity investigations of aluminium oxide nanomaterials 30 nm and 40 nm.**
OP-24: P. Sujatha. Department of Biotechnology, School of Genetic Engineering and Biotechnology, Bharathiar University, Coibatore. **In Vivo toxicity of Titania Nanoparticle interaction within *Danio Aequpinnatus* (Giant Zebra fish)**
OP-25: Pulakesh Aich. Department of Biochemistry & Biophysics, University of Kalyani, Kalyani. **A novel method for transformation of Escherichia coli cells by plasmid DNA using Calcium Phosphate Nanoparticles.**

OP-26: Ajit Kumar Chatterjee. Department of Biochemistry & Biophysics, University of Kalyani, Kalyani. **Enhanced antibacterial activity of Copper nanoparticles stabilized in Gelatin.**
OP-27: M.F. Rahman. Toxicology Unit, Biology Division, IICT, Hyderabad. **In Vitro and In Vivo toxicity study of Silver-25 Nanoparticle treated mice with special reference to Oxidative stress related Gene expression.**
OP-28: S. Karthikeyeni. Department of Animal Sciences, Bharathidasan University, Tiruchirappalli. **Effects of starch (rice-porridge) assisted synthesized Iron Oxide Nanoparticle on Tilapia (Oreochromis mossambicus): Heematology, Antioxidant enzymatic activity and Histopathology.**
OP-29: Geeta Vanage. National Center for Preclinical Reproductive and Genetic Toxicology, National Institute for Research in Reproductive Health, Mumbai. **Polyethylene Sebacate Nanoparticles: Genotoxicity, Mutagenicity Evaluation and Application in Drug Deliver.**
LUNCH (1.30 PM to 2.00 PM)
INVITED LECTURES (2.00 PM to 3.30 PM)
Chairperson: Dr. S.V. Manorama.
IL-13: Dr. B.L.V. Prasad. Materials Chemistry Division, NCL, Pune. Nanoparticles: Dispersions in different media and diverse applications.
IL-14: Dr. Syed S.Y.H. Qadri. Pathology Division, National Institute of Nutrition, Hyderabad. **Animal models for research in Nanotoxicology.**
IL-15: Dr. Sabu Thomas. Centre for Nanoscience and Nanotechnology, Kottayam, Kerala. **Micro and Nanostructured Epoxy Resin Based Polymer Blends.**
TEA 3.30 PM
Oral Paper Presentation I1: Nanomaterial Toxicology (3.45 PM to 4.45 PM)
Chairperson: Dr. B. Dinesh Kumar
OP-30: R. Ramesh. Department of Animal Science, Bharathidasan University, Tiruchirappalli. **Solubilization of TiO_2 Nanoparticles under invitro condition:Implication for Toxicological studies.**
OP-31: K. Sivakumar. Department of Animal Science, Bharathidasan University, Tiruchirappalli. **Influence of oral administration of Zinc oxide nanoparticles in the aquatic animal Oreochromis mossambicus.**
OP-32: P.V. Rekhadevi. Toxicology Unit, Biology Division, IICT, Hyderabad. **Genotoxicity of materials at the Nano level.**
OP-33: Mahendra Rai. Department of Biotechnology, SGB Amravati University, Amravati. **Mycosynthesis of silver nanoparticles using different Fusarium species for the development of novel antimicrobials.**
OP-34: S.R. Radhika Rajasree. Centre for Ocean Research, Sathyabama University, Jeppiaar Nagar, Chennai. **Mortality and cytotoxicity assessment of sonicated and filtered fullerene (C_{60}) in Asian sea bass Lates calcarifer.**
OP-35: M. Asha. School of Biotechnlogy & Genetic Engineering, Bharathiyar University, Coimbatore. **In Vivo Chronic toxicity of Nano Titanium Dioxide on liver and kidney of mice.**
Poster Presentation III: (4.00 PM to 6.00 PM)
Chairperson: Dr. B. Sreedhar

PP-01: Sarala Devi. I & PC Division, IICT, Hyderabad. **Ferric impregnated silica nanoparticles as matrix for enzyme immobilization and biocatalytic activity evaluation.**
PP-02: Aruna Jyothi Kora. CCCM, BARC, Hyderabad. **Synthesis of silver nanoparticles using gum kondagogu *(Cochlospermum gossypium)*.**
PP-03: Vinod Kumar Yata. Dept. of Biotechnology, IITG, Assam. **Core–shell nanogels for therapeutic protein and suicide gene delivery.**
PP-04: VTP.Vinod. Dept. of Biochemistry, OU, Hyderabad. **"Green" synthesis and characterization of gold nanoparticles using a natural biopolymer- gum kondagogu *(Cochlospermum gossypium)*.**
PP-05: S.Sri Lavanya Priya. Biotechnology Centre, Anna University, Coimbatore. **Predicted drug delivery system with nanoengineered improvements based on structural analysis of bestrophin.**
PP-06: Ponniah Senthil Murugan. Department of Biochemistry, Madurai Kamaraj University, Madurai. **Screening and detection of oral cancer protein marker in saliva.**
PP-07: Dilip Pawar. Shantha Biotechnics Limited, Hyderabad. **Mucoadhesive PLGA nanoparticles for nasal immunization against Hepatitis B.**
PP-08: Mayur Temgire. Center for Nanobioscience, Agharkar Research Institute, Pune. **Role of curvature in peg-mediated fusion between differently curved membranes.**
PP-09: T.S.Chandra, Dept of Biotechnology ,IIT Madras ,Chennai. **Application of electrospun nanofibers for packaging and storage of biocidal enzymes.**
PP-10: N. Sailaja. Toxicology Unit, Biology Division, Indian Institute of Chemical Technology, Hyderabad. **An in vivo genotoxicity assessment of silver nanoparticles in rat bone marrow by chromosomal aberration analysis and micronucleus assay.**
PP-11: S.P. Singh. Toxicology Unit, Biology Division, Indian Institute of Chemical Technology, Hyderabad. **Genotoxicological effects of iron oxide (Fe_3O_4) nanomaterial in rats.**
PP-12: Anita K. Verma. Dept of Zoology, University of Delhi, Delhi. **Anti-microbial characteristics of carbon nanoparticles from lamp soot.**
PP-13: Anita K.Verma. Dept of Zoology, University of Delhi, Delhi. **Design of novel non-viral vector for gene delivery. Preparation, characterization and in-vitro expression of a vector for insulin like growth factor binding protein 4 (IGFBP4).**
PP-14: L. Sri Charani. I & PC Division, IICT, Hyderabad. **Magnetite-silica nanocomposites for biological applications: synthesis and characterization.**
PP-15: Gousia Begum, Nanomaterials Laboratory, IICT, Hyderabad. **Bioinspired silicification of monodisperse mesoporous silica nanospheres for sustained and controlled drug delivery.**
PP-16: Joydeb Manna. Nanomaterials Laboratory, IICT, Hyderabad. **Silica nanoparticle-assembled hierarchically ordered microcapsules for removal of oxyanion contaminants from water.**

PP-17: Huma Siddiqui. Fibre Toxicology Division, IITR, Lucknow. **In vitro cytotoxicity of nanoparticles manufactured from total suspended particulate matter prevalent in unorganized bone-based industrial units.**
PP-18: Venkatpurwar Vinod. Department of Pharmaceutics, Poona College of Pharmacy, Erandwane, Pune. **Green synthesis of gold nanoparticles using therapeutically active enzyme.**
PP-19: D. Anand Kumar. Toxicology Unit, IICT, Hyderabad. **Acute oral toxicity study of aluminium oxide nanomaterial in albino rats with special emphasis on biochemical assays.**
PP-20: P.V. Prabhakar. Toxicology Unit, IICT, Hyderabad. **Acute oral toxicity effects of iron oxide nanomaterials in albino wistar rats: role of oxidative stress.**
PP-21: Utkarsh A Reddy. Toxicology Unit, IICT, Hyderabad. **Toxicological evaluation of iron oxide nanomaterial by subacute (28 day) study.**
PP-22: Monica Kumari. Toxicology Unit, IICT, Hyderabad. **Biochemical effect of Iron oxide (Fe_3O_4) nanomaterials in albino wistar rats.**
PP-23: Rajak Shaik. Dept. of Genetics, Bhagwan Mahavir Medical Research Center, Hyderabad. **Toxicology of Nnaoparticles.**
DINNER AT DIAMOND JUBILEE PARK, IICT CAMPUS AT 7.30 PM

November 12, 2009 Venue: IICT, Auditorium

INVITED LECTURES (9.00 AM to 11.00 AM)
Chairperson:Dr. Anil Kandalam
IL-16: Dr. Nelson Duran. IQ-Universidade Estadual de Campinas-UNICAMP, Brazil. **Micro and Nanocrystals P-MAPA (immunomodulator) against Virus and Bacterial infections in Experimental model.**
IL-17: Dr. P. Balakrishna Murthy. Director, International Institute of Biotechnology and Toxicology (IIBAT), Padappai. **GLP for toxicity evaluation of Nanomaterials.**
IL-18: Dr. Anita K. Verma. Nano-Bio-Tech Lab., Dept. of Zoology, K.M. University, University of Delhi, Delhi. **Nanomedicines: Smart Liposomal & Biopolymeric Nanoparticles for Drug Delivery to cancer tissue.**
IL-19: Dr. Rohit Kumar Rana. Nanomaterials Laboratory, IPC Division, IICT, Hyderabad. **Bio-inspired strategies to create Multifunctional Nanostructured Materials by Hierarchical Assembly.**
TEA 11.00 AM
INVITED LECTURES (11.15 AM to 1.15 PM)
Chairperson: Dr. S.V. Manorama
IL-20: Dr. I. Ahmad, Fibre Toxicology Division, Indian Institute of Toxicology Research, Lucknow. **Size dependent Biological reactivity of Micro and Nano Level particles of economically important minerals.**
IL-21: Dr. B. Sreedhar. IPC Division, IICT, Hyderabad. **Nanoengineered materials for catalytic Applications: Silica Core@Shell Nanoparticles.**
IL-22: Dr. Ramanuj, Narayan. Organic Coatings & Polymers Division, IICT, Hyderabad. **Opportunities and Challenges in Hybrid Nano Coatings.**
IL-23: Dr. K. Narasimha Reddy. Department of Physics, Osmania University, Hyderabad. **Preparation and Characterization of Rare earth doped NaYF4 nanoparticles for bio-imaging and photodynamic therapy applications.**
LUNCH (1.15 PM to 2.00 PM)
Oral Presentation IV: Nanomaterial Characterization and Application (2.00 PM to 3.00 PM)
Chairperson: Dr. B.L.V. Prasad
OP-36: Nelson Durán. Instituto de Química, Universidade Estadual de Campinas, Brazil. **Alginate/chitosan nanoparticles: glutathione and s-nitrosoglutathione and their preparation, characterization and nanocytotoxicity.**
OP-37: Vilas Karande. Central Institute for Research on Cotton Technology, Mumbai. **Preparation of cellulose nanofibrils by mechanical process and its characterization.**
OP-38: K. Sesha Maheswaramma. Dept. of chemistry, JNTUACEP, Kadapa. **Electron paramagnetic resonance (epr), optical absorption and infra-red spectral studies basics and applications to material, life and earth sciences.**
OP-39: Aditi Soni. Bhagwant University, Ajmer. **Particle size distribution of mining mineral's nano-particles and its significance in ceramics.**
OP-40: Sudhir Kumar Singh. Tata Steel R & D, Dhanbad. **Application if titanium oxide nano fluid in rapid cooling of steel plate.**

OP-41: B. Mekala Department of Chemical Engineering, IIT Kanpur, Kanpur. **Development and characterization of functionalized carbon nano fibers, an adsorptive material for the in situ removal of persistent organic pollutants (pops).**
OP-42: B.V.Appa Rao, Dept. of Chemistry, NIT, Warangal. **Self-assembled nano film in corrosion protection of copper for application in microelectric packaging.**
OP-43: Ramesh N Ravula, SciTech Patent Art Services Pvt. Ltd., Hyderabad. **Patent research on graphene and related applications.**
CONCLUDING SESSION (3.00 PM – 4.00 PM)
TEA 4.00 PM

ABSTRACTS

(INVITED LECTURES)

ENVIRONMENTAL DEGRADATION RESISTANCE OF FIBER REINFORCED NANOCOMPOSITES

Shaik Zainuddin[a], **Mahesh V.Hosur[a1]**, Ashok Kumar[b], Shaik Jeelani[a]
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Behaviour of fiber reinforced polymeric (FRP) composites is both time and environment dependent. Long term behaviour of FRP composites is affected by factors like temperature, moisture, service load, creep, ultraviolet (UV) radiation, etc. Additional of nanoparticles to traditional composites has shown tremendous promise in terms of strength and stiffness enhancement. Since nanophased composites are of recent origin, it is essential to understand their durability issues before they can be used with confidence in structural applications. Hence, this research was focused on characterization of physical, chemical and mechanical degradation of epoxy and E-glass / epoxy composites infused with 1-2 wt.% nanoclay loading. The samples were subjected to hot and cold conditions for 15, 45 and 90 days respectively. In addition, they were subjected to ultraviolet (UV) radiation with/.without condensation. Moisture absorption kinetics, quasi-static flexure, dynamic mechanical analysis (DMA) and thermo-gravimetric analysis (TGA) studies were performed on nanocomposites subjected to temperature and moisture conditions whereas samples subjected to UV radiation and condensation were subjected to static and dynamic compression testing. The results were and compared with that of control samples. Samples exposed to environmental conditions showed degradation in all the properties in comparison to room temperature conditioned samples. Highest degradation was observed in hot-wet condition samples conditioned for maximum of 90 days. Similar behaviour was observed in nanophased composites but comparatively less degradation in properties. However, 2 wt.% composite samples showed improvement comparison to neat samples, similarly conditioned for all the samples.

IL-02

NANOMATERIALS TOXICOLOGY: AN ART OF SCIENCE

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The advent of nanotechnology has resulted in increased use of nanomaterial based products in daily life. A significant increase in surface area to volume ratio at the nanoscale, giving rise to novel and enhanced mechanical, electronic and optical properties to nanomaterials has made nanotechnology the most promising tool of this century. However, major and simultaneous outcome of this rapidly developing field of nanotechnology are the potential adverse human health effects resulting from exposure to commonly used nanomaterials. Keeping this in view, an attempt was made to assess the genotoxicity of some frequently used nanoparticles (fullerenes and metal oxide nanoparticles) and to understand the mechanism involved. But these nanoparticles falling in the transitional zone between molecular and particle level, gives rise to unique properties yielding many technical challenges which impede nanotoxicity studies. The testing strategies employed in customary toxicological studies when put as such in nanotoxicity studies fall short to meet such challenges.

To assess the toxicity of fullerenes, stable aqueous suspensions of colloidal C-60 fullerenes free of toxic organic solvents were prepared by two methods: ethanol to water solvent exchange (EthOH/*n*C-60 suspensions) and extended mixing in water (aqu/*n*C-60 suspensions). DNA damaging potential of these suspensions was evaluated with respect to human lymphocytes using comet assay. The assay demonstrated genotoxicity for both types of suspensions with a strong correlation between the genotoxic response and *n*C-60 concentration, and with DNA damage observed at concentrations as low as 2.2 μg/L for aqu/*n*C-60 and 4.2 μg/L for EthOH/*n*C-60.

The effects of zinc oxide (ZnO) nanoparticles used as a primary ingredient in cosmetics, were also assessed in human epidermal cells (A431). Our data demonstrate that these nanoparticles not only enter the cells but also posses cytotoxic and DNA damaging potential which could be mediated by oxidative stress. Thus these nanoparticles should be used with caution.

These results clearly emphasize that the environmental health and safety (EHS) implications of any new or upcoming technology like nanotechnology should go hand in hand with the technology development. Also appropriate methods and paradigms should be developed for such studies.

Bibliography

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2. Vyom Sharma, Ritesh K. Shukla, Neha Saxena, Devendra Parmar, Mukul Das and Alok Dhawan. Toxicology Letters 2009; 185: 211-218.
3. Alok Dhawan, Vyom Sharma and Devendra Parmar. Nanotoxicology 2009; 3(1): 1-9.

EVOLUTIONARY NANOTECHNOLOGY & CARBON NANOTUBES : PROSPECTS & CHALLENGES

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Today Nanotechnology has got two dimensions – 1) The 1st one addresses activities that revolves around harnessing material properties at nasnoscale. 2) The other one deals with nanobots or self-replicating molecular machines, commonly referred to as molecular manufacturing. Materials referred to as "nanomaterials" generally fall into two categories: fullerenes, and inorganic nanoparticles. The fullerenes are a class of allotropes of carbon which are basically graphene sheets rolled into tubes or spheres. These include the carbon nanotubes which are of interest both because of their mechanical strength and also because of their electrical properties. In order to ease understanding of nanomaterials, it would be prudent to categorize nanotechnology into 3 parts 1) Incremental Nanotechnology – that improves the properties of materials vide the nanoscale structure controlling, 2) Evolutionary Nanotechnology – which deals with designing nanoscale devises so as to enable them to carry out some meaningful works & 3) Radical Nanotechnology - Endeavoring to develop nanomachines that would exist at the convergence of nanotechnology, information technology & cognitive technology. This talk will focus on the second one – Evolutionary Nanotechnology – that takes advantage of the changes that can take place within materials at the nanoscale due to increased chemical activity & quantum effects. e.g. nanoscale sensors that takes advantage of large surface area of nanotubes. One such material that has attracted the fancy of the research community is the carbon nanotube (CNT), although it is not the main focus of evolutionary nanotechnology. Sometimes referred to as *wonder material of the 21st century*, CNT is probably the ideal replacement for silicon circuits. But there exists a no. of challenges. This talk will attempt to all of those.

IL-04

ADAPTATION OF INORGANIC NANOPARTICLES FOR APPLICATIONS IN BIOLOGY

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Materials science is the study of how materials can be improved and how unknown materials can be discovered to serve purposes that can improve our day-to-day existence. Breakthroughs in the basic understanding and the extraordinary application potential of nanostructured materials have become the major driving force for the current progress and efforts of research in this area. The motivation to study nanostructured materials is principally because these materials exhibit significantly different physical and chemical properties that could lead to new science as well as new products, devices and technologies. Consolidating the old and the new, under the "nanotechnology" opens opportunities for developments in new materials.

The present talk would focus on our efforts directed towards the tailoring of inorganic nanoparticles for a variety of biological applications. These include functionalization of nanoparticles of titanium dioxide, iron oxide etc. to make them suitable for applications like protein purification, DNA binding, antibacterial activity etc. Another methodology is to make polymer inorganic nanocomposites for applications in packaging, solar cells etc.

IL-05

TOXICITY OF NANOMATERIALS: IMPORTANCE OF SURFACE MODIFICATION

Laura K. Braydich-Stolle, **Saber Hussain**
Applied Biotechnology Branch, Human Effectiveness Directorate, Air Force Research Laboratory, Wright-Patterson AFB, OH.

Nanomaterials, defined functionally as have a single dimensional feature within the 1 - 100 nanometers range, have been used to create materials that exhibit novel physicochemical properties and function imparted through this engineered, controlled feature size. Although manufactured nanomaterials are currently being widely used in advancing technology, there is a serious lack of information concerning their toxic effects. The assessment of nanoparticles and their potential interaction with biological systems should be a fundamental requirement before beginning large-scale production and technological implementation of these novel materials. By manipulating the surface and the core-shell structure of nanoparticles (i.e silver), different functionalities can be engineered to explore the molecular behaviors in living cells. Furthermore, research from our laboratory has demonstrated that the biocompatibility of nanoparticles can be altered by changing the surface chemistry of a nanoparticle; and that the stability of that surface modification must be taken into account. The main focus of this presentation will be to discuss the basic research applied to evaluating the biological interactions of nanomaterials and the relationship to material characterization. Such knowledge will not only help to improve nanomaterial safety strategies for the protection of both human and environmental health, but also helps to advance new applications in the field of nanobiotechnology.

IL-06

PERSPECTIVE OF COLLOIDAL HYBRID ORGANIC-INORGANIC QUANTUM DOT COMPOSITES

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In this work, we have observed that capping ligands (trioctyl phosphine oxide (TOPO), oleic acid (OA)) used in the colloidal synthesis of CdSe Quantum Dots (QD's) at an optimum precursor ratio of Cd/Se~2:1 have a profound impact on their dimensions and stability. The role of MEH-PPV/P3HT polymers and its corresponding nanocomposites with CdSe (TOPO/OA) QD's are properly envisaged by changing the surface modification from ligands (TOPO, OA)- to pyridine capping of CdSe QD's by the use of an appropriate binary solvent (chloroform and pyridine) respectively. By varying the concentration of the solvent mixture, effective dispersion of nanocrystals in polymer could be realized. The properties of the resulting dispersions could be tailored by the composition and concentration of QD's in CP. The PL decrease in polymer (MEH-PPV, P3HT) upon addition of CdSe (TOPO/OA) nanocrystals could be attributed either to charge or energy transfer from polymer to nanocrystal. Stern-Volmer plots indicated dynamic quenching and shows higher rate of quenching for MEH-PPV/P3HT:CdSe (TOPO) as compared to MEH-PPV/P3HT:CdSe (OA) nanocomposites. Oleic acid due to its lower nucleation rate and strong coupling with Cd leads to larger crystallite size of CdSe QD's and exhibits higher stability. P3HT polymer owing to its crystalline lamellar structure and ordered morphology prevents the sequestration of CdSe QD's or phase segregation and hence superior morphology and higher photo-stability of polymer-CdSe (TOPO/OA) nanocomposites as compared to the corresponding MEH-PPV counterparts. The higher stability of oleic acid-capped CdSe QD's along with the superior surface morphology of P3HT polymers is the key for the realization of higher efficiency in hybrid organic-inorganic solar cells. *J-V* behavior in P3HT films on dispersion with CdSe quantum dots results in overall increase in hole current and switches the transport from dual conduction mechanism, viz., trap and mobility models to a only trap model. This has been attributed to a decrease in characteristic trap energy E_t from 60 to 32 meV and density of traps H_b from 2.5×10^{18} to 1.7×10^{18} cm^{-3}.

IL-07

NANOMATERIALS IN BIOSENSING

N.Madhusudhana Rao
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Ability to functionalize a single nanoparticle in multiple ways opens up opportunity to design novel and sensitive ways of detecting molecules. A single event can be amplified several fold by incorporating biomolecules such as enzymes using nanoparticles (NP). By incorporating ligands on NPs or using magnetic NPs, specific populations could be enriched and thereby sensitivity/specificity of detection could be tremendously enhanced. We have used iron oxide nanoparticles functionalized with enzymes to detect triglycerides in fluids using solid state pH electrode (Ion selective field effect transistor). This design could be expanded to include other hydrolysing enzymes for detection of their substrate/analyte. Further we use iron oxide nanoparticles in enhancing the contrast in Magnetic Resonance Imaging, an application widely being tested. The organ-specificity of the nanoparticles is improved by conjugating biosimilar ligand molecules.

IL-08

CYCLOOXYGENASE-2 AS A MARKER FOR EVALUATING INFLAMMATORY RESPONSES OF METAL NANOPARTICLES

Nishanth P. Reddy[1], Jyotsna G. Radhika G[1], S. M. Hussain[2], **Pallu Reddanna**[1]
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Recent advances in particle-forming nanotechnology not only widened the applications of nanoscale materials but also provided significant concern regarding their biological effects. Nanoparticles (NPs) with their larger surface area, may exhibit greater propensity to produce oxidative stress and inflammatory responses. Here we present a systematic study on the *in vitro* interactions of different nanoparticles of varied sizes with RAW 264.7 mouse macrophage cells, by taking LPS as a standard inflammatory mediator. RAW 264.7 cells were exposed to silver (Ag), aluminium (Al), carbon black (CB), carbon coated silver (CAg) and gold (Au) NPs of varied sizes, and the morphological changes and inflammatory responses were recorded. Following exposure of macrophages to different NPs, significant increase in IL-6, reactive oxygen species (ROS) generation, nuclear translocation of nuclear factor-kappa B (NF-κB), induction of cyclooxygenase-2 (COX-2) and Tumor necrosis factor-alpha (TNF-α) expression was observed , with maximum in those exposed to Ag NPs followed by the Al, CB and CAg. These pro-inflammatory effects were dependent on the size of the NPs and duration of exposure. The pro-inflammatory responses of NPs were very similar to those induced by LPS, a well known inflammatory mediator and abrogated by prior incubation of macrophages with N-acetyl cysteine (NAC), a known antioxidant. Au NPs, on other hand, showed no such morphological changes and inflammatory responses. These studies reveal that Ag NPs exhibit higher propensity of inflammation followed by Al, CB and CAg nanoparticles, involving ROS and NF-κB signaling pathway leading to the induction of COX-2, TNF-α and IL-6. Gold NPs, however, showed no such pro-inflammatory responses, suggesting their bio-compatible nature and usefulness for various biomedical applications. As nanoparticles induced COX-2, and this being a crucial marker for inflammation, the COX-2 based *in vitro* system can be used for evaluating inflammatory responses of various nanoparticles.

IL-09

PROBING THE INTERACTION OF NANOSTRUCTURES WITH BIOLOGICAL SYSTEMS: A COMPUTATIONAL INVESTIGATION

Anil K. Kandalam
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The exponential increase in the applications of engineered nanomaterials in technological and biomedical field and in consumer products has also increased the possibility of potential toxicity and health hazards caused by these engineered materials. With a large surface area and high reactivity, metal nanoparticles (NPs) and engineered nanostructures, such as C_{60}, CNT, and BN-based fullerenes, are potential candidates to cause adverse environmental and biological effects. Therefore, it is critical to have a an atomic-level understanding of the reactivity of nanomaterials in biological milieu, especially their reaction mechanism with bio-molecules. However, most of the studies performed to date are inadequate to provide a comprehensive atomic-level understanding of interaction of various NPs and nanostructures with bio-molecules.

In this talk, I will discuss the results of our DFT based computational investigations on the reactivity of gold (Au_n) NPs with dopamine. It has been observed that the reactivity of metal NPs, is mostly size-dependent. However, our results show that the reactivity of gold nanoparticles with dopamine is independent of shape and size of the nanoparticle. I will also discuss the preliminary results of the size-dependent reactivity studies of CdSe and ZnO quantum dots, and boron nanostructures with dopamine and DNA nucleobases.

IL-10

FABRICATION AND CHARACTERIZATION OF HIGH STRENGTH NANOCOMPOSITE SINGLE FIBERS FOR MULTIFUNCTIONAL APPLICATIONS

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Recently efforts have been made to develop a high strength, multifunctional nanocomposite polymer fibers for various applications. In our previous studies we have shown that the tensile properties can be significantly improved the by alignment of acicular nanoparticles in polymer matrix through melt extrusion process. Decoration of these acicular nanoparticles with various other nanoparticles such as diamond, SiC, and Ag nanoparticles can improve the mechanical and antimicrobial properties. For this study CNTs or Si_3N_4 were decorated with diamond or SiC or Ag nanoparticles and fabricated in to single fibers of Nylon-6 nanocomposites and characterized for their mechanical, thermal and antimicrobial properties. Silver or diamond nanoparticles were coated on CNTs and SiC nanoparticles were coated on Si_3N_4 acicular nanoparticles using a sonochemical method and these nanoparticles/hybrid nanoparticles were further infused in Nylon-6 polymer fibers through extrusion process. The mechanical and antimicrobial properties of Nylon-6, CNTs/Nylon-6, and silver or diamond coated CNTs/Nylon-6 were characterized with X-ray diffraction, transmission electron microscopy and SEM. The composite fibers of ~ 80μm size were tested for their tensile properties and the strength was found to be 414.27 MPa for silver coated CNTs/Nylon-6, 375.86 MPa for CNTs/Nylon-6 and 240.3 MPa for neat Nylon-6 respectively. These results clearly show that there is an improvement of ~ 172 % in tensile strength for silver/CNTs/Nylon-6 as compared to the neat Nylon-6. The antibacterial activity of silver coated CNTs/Nylon-6 along with CNTs/Nylon-6 and neat Nylon-6 were tested by the broth dilution assay. The antimicrobial test shows a > 90% inhibition with silver coated CNTs/Nylon-6 as compared to the neat Nylon-6.

IL-11

NOVEL SYNTHESIS TECHNIQUES AND APPLICATION OF NANOSTRUCTURED OXIDES

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In the emerging field of nanoscience and nanotechnology, the goal is to make nanostructures or nanoarrays with special properties with respect to those of bulk or single particle species [1]. Nanostructured oxides are playing significant role in different fields of chemistry, physics, biology, and materials science [2]. Nano-oxides are of considerable importance to both fundamental understanding of size-dependent properties and numerous applications in different branches of science. Nanostructured oxides can adopt a vast number of structural geometries with an electronic structure that can exhibit metallic, semiconductor, or insulator characteristics. Oxide nanoparticles can exhibit unique chemical properties due to their limited size and a high density of corner or edge surface sites. In recent years, a number of preparation methodologies have been developed for the synthesis of novel nanostructured oxides. Several methods that are employed for the synthesis of oxide nanoparticles include, precipitation, hydrothermal synthesis, sol-gel, microemulsion, chemical vapor deposition, pyrolysis, self-assembly, combustion synthesis, microwave-assisted synthesis, and so on [3]. Some theses aspects will be elaborated in this presentation. Special focus will be paid to the preparative techniques employed for the synthesis of nanosized ceria-based composite oxides [4,5]. Ceria-based composite oxides are receiving considerable attention recently owing to their wide range of applications in catalysis, materials science, and fuel cell technology [2]. Details on the structure-reactivity relationships of nanostructured oxides also will be addressed in this presentation.

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IL-12

"PRE-CLINICAL EVALUATION OF NANO PARTICLES"

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Modern medicaments represent an indispensable contribution to humankind and to the reduction of morbidity and mortality. The drug discovery not only involves the development of effective, safe drugs. Now, at the beginning of a new century, three powerful technologies have met on a common scale — the nanoscale — with the promise of revolutionizing both the worlds of electronics and of biology. This new field, which we refer to as biomolecular nanotechnology, holds many possibilities from fundamental research in molecular biology and biophysics to applications in biosensing, biocontrol, bioinformatics, genomics, medicine, computing, information storage and energy conversion.

Nano technology and nano medicine is in infancy stage. In the coming years it is projected that the application of nano technology coupled with completion of the sequencing of the human genome, with use of, drug therapy to solve the great killers of our time, such as Obesity, Arthritis, Diabetes, Cancer, Cardiovascular disease, Dementia and so on is certain! However the vision is to Improve health by enhancing the efficacy and safety of nano systems and nano devices which is an ongoing process. The research studies reported have raised concerns that substances prepared based on the nanotechnology known to be harmless in bulk might turn out toxic or carcinogenic. Therefore, the existing guidelines needs to be modified on case-by-case basis keeping in view the potential toxicity at clinical/ molecular level, and based on the nature of compound intended use etc.,

There is a growing concern among the public, scientists, academia and regulatory agencies on guidelines for safety evaluation of such newer categories of products developed viz. nano particles, nano medicine etc. The European union, Japan and USA are regularly updating the regulatory guidelines for such preparations and efforts are at the beginning stage in Indian situations.

IL-13

NANOPARTICLES: DISPERSIONS IN DIFFERENT MEDIA AND DIVERSE APPLICATIONS

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The exciting application potential of nanomaterials, especially metal nanoparticles, have resulted in a plethora of experimental recipes for their synthesis either in water or non-polar organic solvents. Often the stabilization of nanoparticles in different solvents is of paramount importance for their utilization as building blocks from both fundamental and applied considerations. As the as-produced nanoparticles are often soluble in either the aqueous phase or the organic phase but not in both, great amount of work is being done towards the phase transfer of nanoparticles from an aqueous phase into an organic phase and vice-versa. While water dispersibility is an essential criterion to realize bio-applications of nanoparticles, dispersions in organic media can be utilized to obtain interesting assemblies. In this context we have been working on developing various methods to prepare stable and water dispersible metal nanoparticles. The metals studied were Au, Ag and magnetic Co and Ni. Several strategies have been adapted to achieve water dispersity. Recently we have made significant progress in the synthesis of sophorolipids (a dimeric glucose –sophorose- attached to the ω-1 carbon of a fatty acid). These sophorolipids (SLs) have been the centre of interest for their documented antimicrobial, antifungal and antiviral activities. We have shown that these could be employed as good capping agents as well as reducing/capping agents. Another protocol that has been developed in our group is to use BSA as a capping agent for obtaining Au/Ag and Au-Ag alloy nanoparticles. Interestingly we found that BSA can also be used as a reducing agent to obtain Au and Ag nanoparticles under specific conditions though in literature it is mentioned that under normal conditions BSA does not act as reducing agent for Au nanoparticle formation. Our recent endeavors towards preparing functional nanoparticles using a naturally occurring gum as again reducing and capping agent and their utility as drug delivery constructs will also be described. The details of the above results will be succinctly delineated.

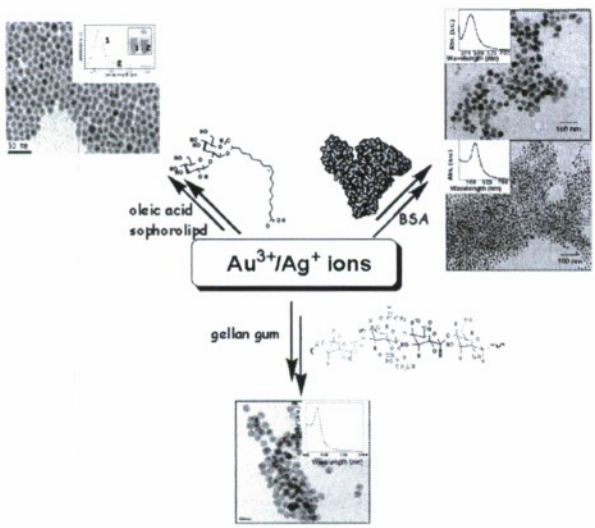

Figure 1: One step aqueous medium based metal nanoparticle synthesis (Au or Ag) using different molecules as displayed above have been reported by us.

IL-14

ANIMAL MODELS FOR RESEARCH IN NANOTOXICOLOGY

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The European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) has characterized nano-particles as < 100 nm in one dimension or < 1000 nm to include aggregates and agglomerates. Composition, dissolution, surface area and other surface characteristics, size, size distribution (including aggregation and agglomeration state) and shape have been identified as the important physical factors that influence the function and the toxicological and environmental characteristics of these particles. Based on the currently available data, nanoparticle induced toxicity has been qualitatively equated with traditional fine sized particles, with the effects in the lung primarily related to inflammation and possibly secondarily to genotoxicity, while systemic effects could impact the cardiovascular and central nervous system. Most of this information on potential systemic effects is said to have been derived from combustion-generated particles[1].

The recommendations for testing these particles include an in vitro screening strategy to assess the possible reactivity of nanoparticle types (including biomarkers of inflammation) along with cellular uptake for prioritization followed by repeated dose inhalation studies with completed standard organ evaluation including biochemistry, hematology, and histopathology of the major organs. This could be supplemented by specific tests to determine subtle effects including inflammation, transcription factors and corresponding gene expression, oxidative stress related to formation of free radicals, and possible secondary genotoxic effects.

In a study using 50 nm fluorescent magnetic nanoparticles (FMNPs) through nose only exposure to mice revealed the distribution of particles in various organs such as liver, testis, spleen, lung and brain. It was observed that FMNPs were able to penetrate the blood brain barrier[2]. Therefore, the two most important exposure routes are the inhalation and dermal routes. The inhalation route involves the respiratory system hence the animal model of choice would have to be that which is free of any respiratory infections. In animals that have been conventionally bred and maintained, mycoplasma infections and/or other etiological agents like viruses and bacteria that cause respiratory infections in animals could interfere with the studies. Animals that are maintained under barrier conditions or in SPF status are also prone to mycoplasma infections and hence may not be the appropriate choice. Similarly, a majority of animals maintained in conventional colonies and in barrier colonies in India are affected with mite, lice and other external parasitic infestations that may affect the skin and hence may be of importance in dermatological toxicity studies. The paper discusses the intricacies involved in selection of animal models for research in nanotoxicology.

IL-15

MICRO AND NANOSTRUCTURED EPOXY RESIN BASED POLYMER BLENDS

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Epoxy based blends have generated a lot interest recently due to their increasing commercial importance. Epoxy resin is often blended with rubbers and thermoplastics to generate micro morphologies for the better impact performance. Very recently, nanostructured blends based on epoxy resin/block copolymers systems have appeared in literature. These nanostructured blends have the potential to show super toughness. In the proposed talk, miscibility, phase separation, morphology, mechanical and viscoelastic properties of a series of epoxy based blends will be discussed. The phase separation, gelation and vitrifcation will be investigated detail. More attention will be given to the development of nanomorpholgies. Techniques such as SEM, TEM. OM , laser light scattering, rheology will be made use of for the characterization of the morphologies. Finally the role of the nano and micromorphologies on the mechanical and viscoelastic properties will be disused.

IL-16

MICRO AND NANOCRYSTALS P-MAPA(IMMUNOMODULATOR) AGAINST VIRUS AND BACTERIAL INFECTIONS IN EXPERIMENTAL MODEL

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In our study we show that the immunomodulator P-MAPA, is effective against virus and bacterial infections assessed in Punta Toro virus (PTV) and *L. monocytogenes* experimental models. All of two diseases have in common as characteristic feature, an ineffective cell-mediated immune response, by which they block or reduce the efficiency of the immune response of the host body, particularly the Th-1 type immune response. Methods, Results and Discussion: P-MAPA increased after *L. monocytogenes*, interferon-gamma and interleukin-2 levels, 48 and 72 h after challenge in comparison to saline-treated animals. Interleukin-4 and interleukin-10 were not altered either by the infection or P-MAPA, suggesting an up-regulation of antilisterial immunity by enhancing Th1-type response. Preliminary assessment of P-MAPA activity against virus were also compared with P-MAPA nanocrystal. After challenge, P-MAPA was administered i.p. as a single dose 24 h p.i. The 100 mg/kg dose reduced systemic viral burden and hepatic icterus (liver discoloration score) assayed on day 3 p.i. and was remarkably effective (100% protection) in preventing death due to PTV infection. Conclusions: P-MAPA appeared as an efficient immunododulator in two important diseases.
Acknowledgement: Supported by Farmabrasilis (Brazil) and by National Institute of Allergy and Infectious Diseases-USA (NIAID) Contract N01-AI-15435, Virology Branch.

IL-17

GLP FOR TOXICITY EVALUATION OF NANOMATERIALS

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The safety of nanotechnologies was first raised in the OECD Chemicals Committee in November 2004. This was followed by two events: Special Session on the "potential implications of manufactured nanomaterials for human health and environmental safety" (June 2005). Workshop on the Safety of Manufactured Nanomaterials (December 2005). In 2006, the OECD established the Working Party on Manufactured Nanomaterials (WPMN). The main objective of this working party is to promote international co-operation in human health and environmental safety related aspects of manufactured nanomaterials (MNs), in order to assist in the development of rigorous safety evaluation of nanomaterials. Hence it is necessary to establish reliable and relevant models to systematically scrutinize the factors that confer adverse cellular reactivity of nanoparticles in order to understand any potential hazard/ risk and, if necessary, to develop safe nanomaterials. The development of a risk management system for nanoscale or ultrafine particle-types requires a base set of hazard data. Assessing risk is a function of hazard and exposure data. This base set process is modeled, in part, on the preparation of the SIDS (screening information data sets) used by OECD (Organization for Economic Co-operation and Development) and US EPA (United States Environmental Protection Agency) for the investigation of HPV (High Production Volume) chemicals.

The minimum base set is an evolving concept designed to characterize the hazards associated with exposures to nanomaterials, both in mammalian species as well as in ecological environments. Justification for these particular tests rests on the following criteria: (1) potential routes of exposures (i.e., pulmonary, dermal, oral and/or ocular); (2) screening for potential carcinogenic effects (mutation and chromosomal aberration assays); and (3) screening for potential toxic aquatic effects (exposures to rainbow trout, Daphnia, and algae).

Needless to say that all the above studies must be done under the ambience of OECD principles of Good Laboratory Practices (GLP). The issues of GLP relevant to these studies will be discussed.

IL-18

NANOMEDICINES: SMART LIPOSOMAL& BIOPOLYMERIC NANOPARTICLES FOR DRUG DELIVERY TO CANCER TISSUE.

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Nano-enabled technologies hold great promise for medicine and health. Drug delivery is as important as the development of new drug entities. The main goal of drug delivery is to transport drugs to diseased sites using a therapeutic dosage. Nanotechnology-based tools and techniques are rapidly emerging in the fields of medical imaging and targeted drug delivery. Employing constructs such as liposomes, nanoparticles, nanoconjugates, and quantum dots, these advances lead toward the concept of personalized medicine and the potential for very early, even pre-symptomatic, diagnoses coupled with highly-effective targeted therapy. A number of nanocarriers have been proposed based on natural and synthetic materials to achieve such a goal. However, the method of delivering drugs to specific cells and cell compartments remains a challenge.

The aim of our study is to develop Liposomes and biopolymeric nanoparticles for transporting drugs/genes to specific tissues, thereby alleviating or eliminating the side effects associated with the use of conventional delivery systems and improving the efficacy of drug or gene therapy. In this talk, pH-triggered nanoparticles and liposomes will be discussed. The structure of these nanoparticles is stable in the normal physiological environment (pH 7.4), but deforms and releases the enclosed drug molecules in an acidic environment. Release Kinetics, Cellular uptake of the nanoparticles, are important parameters to study for exploiting the therapeutic potential of these nanoparticles as it provides improved control over the pharmacokinetics (PK) and pharmacodynamics (PD) of the encapsulated drugs relative to free drugs.

Keywords: drug delivery, liposomes, nanoparticles, nano-conjugates, release kinetics pharmacokinetics, biodistribution.

IL-19

BIO-INSPIRED STRATEGIES TO CREATE MULTIFUNCTIONAL NANOSTRUCTURED MATERIALS BY HIERARCHICAL ASSEMBLY

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The bio-inspired synthesis has lately been emerging as an important environmentally friendly "green" route to generate inorganic materials with controlled morphologies by using bio-extracts or related molecules as structure directing agents. Particularly the biomimetic approach based on diatom biomineralization can be judiciously utilized to get useful functional materials and hence provides great potential for developing completely green processes to obtain structured materials of nanometer dimensions. Here we describe a simple but versatile bio-inspired polyamine-catalyzed silicification method designed to synthesize functional materials under mild conditions similar to that in biosilicification processes. The versatility of the method is exemplified in controlling the size, uniformity and the nano-architectural features of the resulted silica. Further, the use of FITC tagged Polyamine as mineralizer straightaway affords the formation of fluorescent silica nanoparticles particularly suitable for their use in biological (cellular uptake and delivery) studies as stable and efficient intracellular labeling agents. These positively charged polypeptides and polyamines can as well catalyze mineralization of materials other than silica. Importantly, the self-assembly property of these polypeptides can be extended to assemble nanoparticles to form hierarchical nanostructured materials having potential applications in encapsulation applications.

IL-20

SIZE-DEPENDENT BIOLOGICAL REACTIVITY OF MICRO-AND NANO- LEVEL PARTICLES OF ECONOMICALLY IMPORTANT MINERALS

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One of the economically important minerals is talc in India which is the third largest producer of talc in the world. Talc is largely used in the manufacture of cosmetic powders like face powder, baby powder and body powder. Its industrial use is innumerable such as in the production of paper, rubber, plastics, paints, ceramics, insecticides and pharmaceuticals. Use of talc in nano particle powder form is the recent introduction for improving the quality of these industrial products. Risk of occupational exposure to different particle size is tremendous in India under mining, milling and industrial work environment. Whether biological reactivity of these minerals in micro- to nano- scale will be similar or different is a matter of present interest. Thus, attempt was made to assess the size-dependent toxicity of following particle sizes (I) 60-65 nm (II) 1-2 μm (III) 8-10 μm and (IV) 55-60 μm of talc through their effects on cell viability and lipid peroxidation (LPO) in primary hepatocytes in vitro. It was observed that cytotoxicity was dependent on both concentration as well as particle size of talc. LC_{50} values of these particles were determined as 31.25 μg/ml, 123.78 μg/ml, 247.56 μg/ml and 502.80 μg/ml for I, II, III and IV, respectively. LPO activity of these particles was also dependent on their concentration and particle size. Particle concentrations required for enhancing LPO by 50% were 62.53 μg/ml, 243.68 μg/ml, 498.84 μg/ml and 989.67 μg/ml for I, II, III and IV, respectively. Notably, talc is occasionally contaminated with asbestos in its natural environment, therefore talc-based cosmetic powder (TbCP) accordingly get contaminated. By phase contrast and polarized light microscopic analysis of 24 samples of TbCP showed asbestos contamination with fibres in the range of 1.80% to 21.4%. Interestingly, cytotoxicity study on asbestos contaminated TbCP suggested that it is correlated with the levels of asbestos contamination. Contaminating asbestos fibres were mostly amphiboles (more carcinogenic varieties) and predominantly tremolite. Thus exposure of talc poses risk of coexposure to tremolite, therefore tremolite toxicity was also studied in a size -dependent manner. Though tremolite toxicity was more than talc but its pattern of biological reactivity causing membrane damage and lipid peroxidation was similar to that of talc. Based on present study, it is concluded that (a) toxicity of mineral particles in nanoscale gets tremendously increased (b) mineral particle nanotoxicity is mediated through oxidative stress. It is extrapolated from the present study that regulatory guidelines on asbestos contamination as well as particle size of minerals in cosmetic powders have become necessary in the interest of societal health benefits.

IL-21

NANOENGINEERED MATERIALS FOR CATALYTIC APPLICATIONS: SILICA CORE@SHELL NANOPARTICLES

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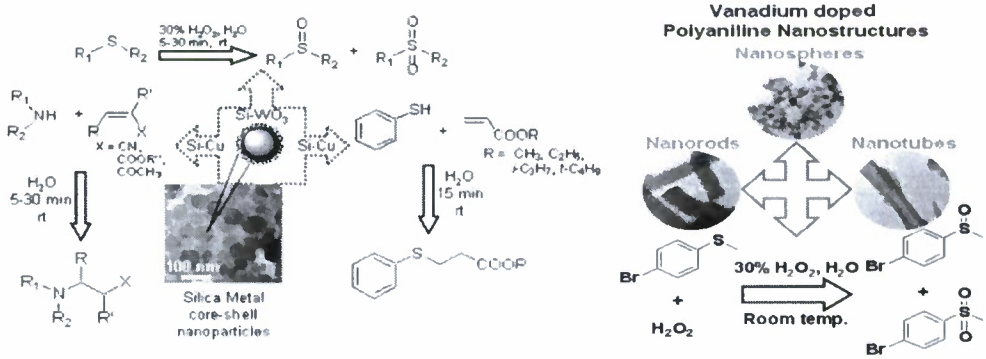
Nanomaterials, with their unique physical and chemical properties, hold promise for applications in a wide range of sectors including catalysis, electronics, photonics, telecommunications, biotechnology, medicine, aerospace, and energy. Most nanostructures are primarily surface rearrangements of atoms. In light of this, the characterization of the surfaces and the interfaces of nanomaterials is paramount for understanding their properties and functionalities. In recent years, significant developments have taken place in the design of new approaches for understanding the surface and/or interfacial properties of nanomaterials. These developments have further fueled a quest for exploration of new applications of nanomaterials on surfaces and at interfaces. Surface studies are extremely important for nanomaterials because not only is the surface structurally and chemically quite different from the bulk, but its properties tend to dominate at the nanoscale due to the drastically increased surface-to-volume ratio. Regardless of the approach, nanostructured materials present a variety of obstacles to adequate, useful, and needed analysis. Case studies of measurements on silica core/metal oxide-shell nanoparticles, hollow iron oxide and polyaniline in varied morphologies such as nanotubes, nanorods, and nanospheres are used to introduce some of the issues that frequently need to be addressed during analysis of nanostructured materials. We use a combination of tools for routine analysis including X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), atomic force microscopy (AFM) and X-ray diffraction (XRD) and apply several other methods as needed to obtain essential information. The examples provide an introduction to other issues and complications associated with the analysis of nanostructured materials including particle stability, probe effects, environmental effects, specimen handling, surface coating, contamination, and time.



IL-22

OPPORTUNITIES AND CHALLENGES IN HYBRID NANO COATINGS

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The rapid growth and advances in nano science and technology in last decade, has originated many newer and novel approaches for the design and development of coatings for different functional, protection and decorative purposes. Today each coating segment is trying to adopt nano concept in the formulation and development to sustain and increase their market potential. Environment, Energy and high technical performance coupled with low cost seems to be the main challenges for the coating technologist today. The judicious use of nanotechnology in the coating product and process development holds the key in meeting the above challenges. Of the various nano concept based coatings, the organic inorganic hybrid nano coatings has drawn maximum attention due to availability of wide array of different well defined organic and inorganic nano materials and formation of hybrid structure through different methodologies. The appropriate and effective use of nano materials are being implied and giving rise to new coating technologies with added functionalities such as self cleaning, self healing, light sensitive, high scratch resistance, antimicrobial, protection at lower thickness etc.

Our research group is actively engaged in the development of hybrid nano coatings for protective and functional purposes. We will present and compare the different hybrid coatings developed in our research group with emphasis on the background concept, different developmental stages, and structure property relationship. The application of sol gel materials and nanomaterials from mine/mineral rejects or industrial wastes will also be discussed. We will also try to show the development in polymers along with nanomaterials combine to give multifunctional coatings to minimize the multilayer protective architecture. Finally a global trend on opportunities and challenges in area of hybrid coatings with industrial perspective will be presented.

IL-23

PREPARATION AND CHARACTERIZATION OF RARE EARTH DOPED $NAYF_4$ NANOPARTICLES FOR BIO-IMAGING AND PHOTODYNAMIC THERAPY APPLICATIONS

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Today Nanoscience and Nanotechnology are the fastest growing branches of science and technology with ramifications into multitude of areas such as Nano-medicine, quantum well lasers, Solar energy, Nano-electronics and Devices and Quantum Computations etc. Luminescent nanocrystals, termed as nanophosphors have been extensively studied during the last decade due to their unique optical properties which makes them ideal for a wide spectrum of applications ranging from flexible displays, lasers to biological imaging and therapeutic agents.

$NaYF_4$ is a highly multifunctional material with highly promising potential application for IR to visible up conversion process. $NaYF_4$ nanoparticles doped with certain rare earth impurities have also attracted great interest. Because they emit intense visible luminescence under near infrared light excitation. This process known as Anti stokes process is very useful for application in bio-imaging process and photodynamic therapy. The up conversion process in rare earth ions exhibit a strong power dependence on excitation intensity thereby provides a high intensity emission with excellent special resolution. Bio-imaging using these up converting nanophosphors provides background free detection. In order to study these aspects some up conversion nanoparticles such as $NaYF_4$ doped with lanthanide ions (Er^{3+}, Ho^{3+} and Tm^{3+}) have been synthesized using chemical route and homogeneous precipitation methods. These nanoparticles are not soluble in water, biocompatible and do not functional chemical groups for conjugation of biomolecules. This limits the bio-application of these nanoparticles. In order to enhance the applicability of these nanoparticles in bio-imaging some surface modifications have to be performed. This can be achieved by dispersing these nanoparticles in polymers such as polyethleneimine, polyvinlye alcohol and polypropylenes etc. This makes the nanophosphors water soluble and biocompatible. The amino groups of the polymer exiting on the nanoparticles can be used for attachment of biomolecules.

In the present paper, issues related to preparation and characterization of $NaYF_4$ based nanophosphors and their applications to up-conversion process will be presented.

ABSTRACTS

(ORAL PRESENTATIONS)

OP-01

A NOVEL ONE POT GREEN SYNTHESIS OF STABLE SILVER NANOPARTICLES USING TANNIC ACID AS A REDUCING AGENT

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Development of environmental friendly procedures for the synthesis of metal nanoparticles through biological processes is evolving into an important branch of nanobiotechnology. Among various nanoparticles which have found commercial applications, the silver nanoparticles find several applications. The antibacterial effect of silver nanoparticles has resulted in their extensive application in health, electronic and home products. Thus, there is a need to develop an environment friendly approach for synthesis of silver nanoparticles that does not use toxic chemicals in the synthesis protocol.

Tannic acid is a polymer of gallic acid molecules and glucose. Tannic acid has anti-bacterial and antioxidant properties. We used tannic acid for the synthesis of silver nanoparticles from aqueous silver nitrate solution (i.e. through the reduction of Ag^{+} to Ag^{0}). Trisodium citrate was used as a capping agent. The silver nanoparticles were characterized using Zeita sizer, UV–vis spectrophotometer, EDAX and X-ray diffraction studies. Scanning electron microscopy of the silver particles indicated that the particles so synthesized were spherical in shape. Fine control over the nanoparticle size was achieved by varying the concentration of reducing agent. A decrease in average particle size was obtained with higher concentration of tannic acid.

The synthetic route thus used provides an economical technique to produce stable silver nanoparticles using water as a solvent. This reaction was completed within a short time period of around 5-10 minutes and is easily reproducible. As tannic acid possesses antibacterial and antioxidant properties, the silver nanoparticles synthesized using tannic acid may have better antibacterial properties and lower toxicity.

OP-02

REUTILIZATION OF BIOLOGICAL WASTE MATERIAL : PREPARATION OF POROUS HAP.

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In the present work, hydroxyapatite (HAp) was successfully synthesized by two different sol-gel synthesis methods using dried dead snail shells, (a special type of biological wastes), $(NH_4)_2HPO_4$, and NH_4OH as starting materials. The gelatinous precipitate was washed repeatedly with distilled water to remove unwanted ions and dried overnight in an oven at 100 ^{o} C and then calcined at 800^{0}C for 2 hour. The powder sample was characterized by scanning electron microscopy , Malvern Particle Size Analyzer, X-ray Diffractometer (using Cu-Kα radiation). FTIR spectra with a Perkin-Elmer (S2000) IR spectrometer, NETZSCH-Geratebau GmbH Thermal Analyzer, and BET surface area analyzer.

As a result, the HAp particle exhibited a micrometer-sized spherical shape where Average particle size was found to be 2.63 μm. Small amount of fine particles (0.2-0.3 μm) are also present in the synthesized powder. Several methods are there to produce pours HAp. The simplest method involves the incorporation of volatile compounds during the heating process. Here HAp synthesized from snail shells is used as the raw materials naphthalene is used as the organic additive. Porous HAp ceramics with porosity up to 53% have been successfully and rapidly fabricated The porosity of the ceramics can be controlled by adjusting the starting material, green density, sintering time, or temperature. Pore size can also be adjusted.

OP-03

PALLADIUM NANOPARTICLES MODIFIED TITANIUM DIOXIDE NANOTUBE AND ITS ELECTROCATALYTIC APPLICATION IN HYDRAZINE OXIDATION

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Titanium oxide (TiO_2) nanotube was synthesized by using linen fibre as template in the presence of 2 mM of Titanium tetrafluoride (TiF_4) at 60^0C for 10 minutes. Nanotubes were isolated after burning of linen fibre at 500^0C in a temperature controlled muffle furnace. The surface modification of the TiO_2 nanotubes with palladium nanoparticles can be achieved by dispersing TiO_2 nanotube in 1mM solution of $PdCl_2$ for about 10-30 minutes followed by the reduction with 100 mM of sodium borohydride for a few seconds. The palladium nanoparticles modified titanium oxide nanotube can be used for electrocatalytic oxidation of hydrazine.

OP-04

SINGLE POT SYNTHESIS OF CADMIUM SULFIDE NANOWIRES BY THERMAL DECOMPOSITION OF CADMIUM DIETHYL DITHIOCARBOMATE

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Cadmium sulfide (CdS) nanowires have been synthesized by thermal decomposition of cadmium diethyl dithiocarbomate in the presence of dodecylamine at 100^0C under reflux condition. The resulting CdS nanowires were isolated after extensive washing with acetone and methanol. The optical characteristics of CdS nanowires were tested by UV-visible and emission studies. TEM and XRD studies provide the size, shape and crystallanity of nanowires. These CdS nanowires can be applied for the effective photocatalytic decomposition of Rhodamine B at 354 nm irradiation.

OP-05

SYNTHESIS OF MANGANESE DOPED THIOL PROTECTED ZINC SULFIDE NANORODS AND ITS APPLICATION ON IMAGING OF CANCER CELLS

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We have synthesized Zinc sulfide (ZnS) nanorods by thermal decomposition of zinc diethyl dithiocarbomate in the presence of dodecylamine at 100^0C under reflux condition. The resulting solution was washed with excess methanol to give ZnS nanorods which were then dissolved in hexane. Similarly, 5% Mn doped ZnS nanorods were also prepared in the presence of $MnNO_3$ as a dopant. These hydrophobic nanorods were made to be hydrophilic by functionalizing the nanorods with water soluble thiols like Mercaptopropionic acid to solubilze them into water. The optical characteristics of ZnS nanorods were tested by UV-visible absorbance spectroscopy and PL measurement studies. TEM and XRD studies provide the size, shape and crystallanity of nanorods. These nanorods are green fluorescent in nature. These nanorods can be used for imaging of various types of cancer cells such as HL 60, MDA-MB 231, and HeLa.

OP-06

NEW FRONTIERS IN SURFACE CHARACTERIZATION WITH IMAGING ELLIPSOMETRY

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In this paper we look at Imaging Ellipsometry, its versatility and the ease with which it can be adapted with other instruments to build new characterization techniques built into one system.

Classical Ellipsometry has been in use as a powerful characterization technique for thin films for over 100 years. With Imaging Ellipsometry the size of the object under investigation may be reduced to the micrometer range and by this accomplishing the need to measure on micro-structured samples. For example, reactive coatings on cantilever-based microsensors may be characterized by Imaging Ellipsometry, being inaccessible to the large spot size of conventional ellipsometers.

Simutaneously, it is possible to generate maps of ellipsometric data with spatial resolution down to a micrometer, while preserving the sub-nm film thickness resolution of a classical ellipsometer. Spectroscopy at the imaging level is possible from 350-1000nm, to be extended shortly in the UV range. Imaging Ellipsometer EP3 is also used as an imaging SPR (surface plasmon resonance) spectrometer, with extra sensitivity by employing a ultrathin metallic layer (typically a 50nm gold layer), thereby enabling the detection of binding processes or molecular reactions, mainly for biologically relevant samples like proteins or for sensing applications.

Another mode of operation is Brewster Angle Microscopy, which is particularly suited for imaging of organic monolayers at the air water interface. Brewster Angle Microscopy, developed by one of the founders of Accurion, today is a standard method for Langmuir-Blodgett films. Time-resolved Brewster Angle Microscopy in the nanoseconds regime has been demonstrated recently based on our instruments.
The product range for this research field is complemented by a sensitive UV-VIS-NIR reflection spectrometer for the air/water interface.

A current trend is to combine information from multiple methods. Consequently, one development focus at Accurion today is to combine Imaging Ellipsometry with other surface characterization technologies. To this end, a combination with AFM is available (EP3-SPEM). Other combinations, for example with infrared reflection spectroscopy (PM-IRRAS) are currently developed together with partners.

OP-07

BIOSYNTHESIS OF GOLD NANOPARTICLES MEDIATED BY A NOVEL MARINE SPONGE EXTRACT

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Exploration of bacteria, fungi, actinomycetes and plant materials for the biosynthesis of nanoparticles is considered as eco friendly and green technological approach is the growing trend in nanobiotechnology. The present study reports the synthesis of gold (An) nanoparticles from gold precursor using the extract derived from the marine sponges belongs to the primitive phylum Porifera. Water-soluble organics present in the marine sponge extract were mainly responsible for the reduction of gold ions to nano-sized An particles. UV–vis spectrum of the aqueous medium containing gold nanoparticles showed a peak at around 547 nm. Transmission electron microscopy (TEM) micrograph analysis of the gold nanoparticles indicated that they were well-dispersed. Through Fourier transform infrared spectroscopy (FT-IR) analysis the reducing agent in the marine sponge extract was identified which is attributed for the biosynthesis of gold colloids.

OP-08

MECHANICAL BEHAVIOUR OF NANOMATERIALS PRODUCED BY SEVERE PLASTIC DEFORMATION AND STUDY TOWARDS INDUSTRIAL APPLICATIONS

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To date, mechanical properties like hardness, elastic modulus, fracture toughness, creep, fatigue, scratch resistance, wear, etc. and also erosion and corrosion resistance have not been studied much in nanostructured samples because the measurements require large samples in order to reach the required plane strain condition. It is reasonable to anticipate this will become feasible within next few years as facilities are established to produce large samples through severe plastic deformation (SPD) methods. This paper deals with the mechanical behaviour of nanomaterials by SPD and processing methods as well as microstructural features resulting in the enhancement of mechanical properties for advanced applications. Recent years have seen growing interest in developing the most successful top-down approach in which materials are subjected to the application of SPD processing to fabricate bulk nanostructured materials with unique properties. This approach is based on SPD which is defined as a metal forming method under an extensive hydrostatic pressure that may be used to impose a very high strain on a bulk solid without the introduction of any significant change in the overall dimensions of the sample and having the ability to produce exceptional grain refinement. SPD produced nanomaterials are fully dense and their large geometric dimensions make it possible to perform thorough mechanical tests, and this is attractive for efficient practical applications. SPD materials are viewed as advanced structural and functional materials of the next generation of metals and alloys. Today, SPD methods are emerging from the domain of laboratory scale research into commercial production of various ultrafine-grained materials. This change is manifested in several ways. First, it is characterized by the fact that not only pure metals are investigated, but also commercial alloys for various applications; second, by developing several approaches to enhance properties of ultrafine-grained metals and alloys.

Bulk nanomaterials are derived from their unique microstrucures which control deformation mechanisiums and mechanical behaviour that are found to be high strength, good ductility, superior superplasticity, a low friction coefficient, good thermal stability, high wear resistance, enhanced high-cycle fatigue life, and good corrosion resistance. Normally materials having high strength usually exhibit low ductilities irrespective of whether their strength is achieved through compositional differences, themomechnical processing, phase transformations or other methods but where as the materials processed by SPD methods will exhibit high strength and high ductility which are mostly required for any structural applications. In nanostructured materials, for example, several stratcgies have been

proposed to produce high strength and good ductility at the same time. These include the introduction of microstructures to change the deformation mechanism by means of SPD technologies, special thermomechanical treatment which can result in a grain size distribution in nanocrystalline and combining second-phase particles or laminar materials in a nanostructured metallic matrix. Although in some cases the ductility of nanostructured materials can be improved, it remains extremely difficult to produce large-scale and cost-effective nanostructured materials for structural applications that require both high strength and high ductility.

SPD methods, available at the laboratory scale level to produce bulk nanomaterials are Equal-Channel Angular Pressing (ECAP), High-Pressure Torsion (HPT), Accumulative Roll Bonding (ARB), Repetitive Corrugation and Straightening (RCS), Hydrostatic Extrusion (HE), Cyclic Extrusion – Compression (CEC) and Multiaxial Forging (MF). Out of all these the most developed procedure and the technique are ECAP and HPT and these methods are under consideration to produce

OP-09

MEASUREMENT OF VOID –SPECIES NANOSTRUCTURE OF MODIFIED BATIO3 CERAMICS WITH FSDP RELATED XRD

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Void-species nano structure is studied in Ba_{1-x} Ca_x TiO_3 ceramics using X-ray diffraction with respect to the first sharp diffraction peak (FSDP-related XRD). The FSDP parameters such as the interlayer separation, quasi-periodic in nature with an effective periodicity R, and correlation length L, over which such periodicity is maintained, of atomic-density fluctuations, regardless of the precise atomic origin of such fluctuations, were calculated using general expressions. Void-based model may be a very useful experimental tool to study the above nanostructural peculiarities in crystalline solids. The present work is aimed to clarify methodological possibilities of this approach with the calcium modified barium titanate ceramics for the first time. In this paper we have reported for the first time, the effect of doping concentration of calcium on BaTiO3 on different parameters like; structural correlation length, periodicity, nanovoid diameter, the first coordination sphere radius, the magnitude of scattering vector etc.

OP-10

PANI/ FE_3O_4 MAGNETITE NANOCOMPOSITES: AN EFFICIENT AND REUSABLE CATALYST FOR SYNTHESIS OF DIARYL ETHERS

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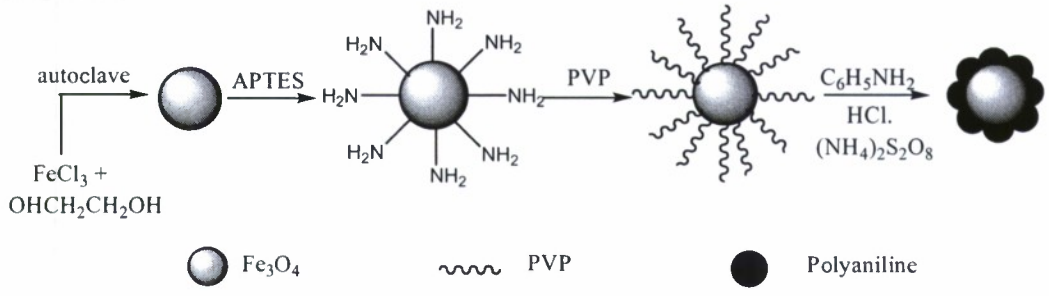
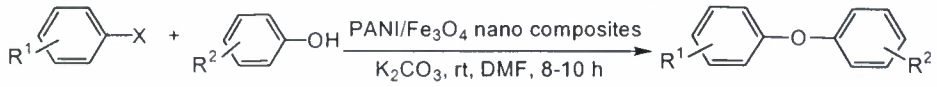
$PANI/Fe_3O_4$ nanocomposites have attracted much attention for applications of nano materials due to their novel magnetic, conducting and catalytic properties.[1] To date, effective coating of magnetic particles with natural or synthetic polymers is still a challenge. This is because of hydrophilic nature of surfaces of the magnetic particles and hydrophobicity of polymers. Therefore, the development of an efficient method to access direct coating of PANI onto Fe_3O_4 particles is still challenging. Herein, we report a new synthesis of $PANI/Fe_3O_4$ magnetite nanocomposite via in situ preparation of functionalized Fe_3O_4 nanoparticles core shell microspheres coating with polymer. (Scheme 1) Through this surface-modified procedure, high-content super paramagnetic Fe_3O_4 containing Fe_3O_4 nanoparticles-PANI composites were obtained with well-defined blackberry-like morphology.



Scheme 1.

These $PANI/Fe_3O_4$ magnetite nanocomposites were fully characterised by XRD, XPS, TEM and BET and used for C-O bond formation between phenols and aryl halides for the first time.

Diaryl ethers constitute an important class of organic compounds that are of paramount importance throughout the polymer and life-sciences industries.[2] Many of them have been shown to possess significant biological activity such as the antibiotic-vancomycin and the anti-HIV agents-chloropeptins.[3] With this growing repertoire of applications, the development of efficient methods for the synthesis of diaryl ethers continues to be a challenging and active area of research.



X=Br, I; R^1, and R^2 = electron withdrawing, electron donating groups

Scheme 2.

The one-pot recyclable Fe_3O_4 nanoparticles@PANI core-shell catalyzed C-O bond approach represents an efficient protocol for the synthesis of a wide variety of diaryl ethers.(Scheme 2) This ligand- and base-free PANI/ Fe_3O_4 magnetite nanocomposites afforded good to excellent yields of diaryl ether in short reaction times at room-temperature. Recoverability of the catalyst due to its strong magnetic property, easy product isolation and reusability in several cycles with consistent activities makes this process attractive for the synthesis of variety of diaryl ethers.

OP-11

NANO BIOSENSOR FOR PESTICIDE DETECTION IN WATER SAMPLES AND FRUIT JUICES (COMBINED WORK CARRIED BY THE HARBIN INSTITUTE OF TECHNOLOGY, CHINA AND INDIAN INSTITUTE OF TECHNOLOGY – ROORKEE, INDIA)

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The present world is replacing the convential materials with Nanomaterials due to their promising applications in diverging fileds from Biotechnology to Material science. Nanomaterials show peculiar properties with in the size range 1 – 100 nm , we can exploit these properties for our beneficial applications. The present paper describe the role of single wall carbon Nanotubes to enhance the detection limit of Pesticide in the water samples.

This work explains the most efficient single step method to fabricate the Nanobiosensor for the pesticide detection in the water samples by the LBL assembly method. The enzyme acetyl choline esterase is used as the biological element . All the electrochemical measurements were measured by the Parstat 2273 instrument. The sensitivity of the sensor was found to be the best compare to the other methods. Detection Limit of pesticide in the sample also analysed.

This sensor can be used to detect the pesticide in water samples and fruit juices spontaneoulsy replacing the convential methods like chromatography which require skilled persons for detection.

OP-12

ROLE OF ACTINOMYCETES FROM HUTTI GOLD MINES AND OTHER NOVEL ISOLATES FOR THE SYNTHESIS OF SILVER AND GOLD NANOPARTICLES

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Nanoscience is one of the most important research and development frontiers in modern science. Nanoscience and Nanotechnology are at the leading edge of the future. Metal nanoparticles exhibit unique electronic, magnetic catalytic and optical properties that are different from those of bulk metals. Nanotechnology concerns the science of very small particles and deals with both the fundamental aspects of understanding the properties of such nanoparticles and with developing technological applications of nanoparticles. The synthesis of nanoparticles has, in particular, received considerable attention. The development of techniques for the controlled synthesis of metal nanoparticles of well defined size, shape and composition is a big challenge. The use of the highly structured physical and biosynthetic activities of microbial cells for the synthesis of nanosized materials has recently emerged as a novel approach for the synthesis of metal nanoparticles. Green nanotechnology is emerging day to day for the synthesis of noble and other metal nanoparticles for various applications. The interactions between metals and microbes have been well documented. Among microbes actinomycetes (ray fungi or filamentous prokaryotes) can be regarded as best nanofactories as they posses dual characteristics of bacteria and fungi, as many of the actinomycetes are known to produce various bioactive molecules such as enzymes, proteins vitamins and antibiotics, they can be regarded as bionanomaterial producers. The genus Streptomyces being one of the major antibiotic producers among actinomycetes, is a wide and major group of actinomycetes present in soil, is now being explored for the synthesis of noble metal nanoparticles as they are known for antimicrobial and catalytic activity. Silver nanoparticles find important applications in various fields such as material for electrical batteries, polarizing filters, stain selective coating for solar energy absorption, they also find use as optical receptors and as catalysts in chemical reactions also have a wide variety of applications in textile industries due to its antibacterial activity. Gold nanoparticles find applications in rheumatoid arthritis as anticancer agent, gold colloids are also used in various tonics etc. Since gold and silver nanoparticles are finding more applications hence their synthesis is also gaining much importance, synthesis of noble metal nanoparticles by Streptomyces has indeed proved to be promising in our studies and our further work on optimization and application of silver and gold nanoparticles studies are ahead.

EXTRACELLULAR SYNTHESIS OF GOLD AND SILVER NANOPARTICLES USING DRIED LEAVES OF *VITEX NEGUNDO* LINN

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The synthesis of nanocrystal is in the limelight in modern nanotechnology. The present study deals with the novel synthesis method of gold and silver nanoparticles using sun dried leaves of *Vitex negundo* Linn. On the treatment of aqueous solution of $AgNO_3$ (1mM) with dried leaf biomass of *Vitex negundo* Linn., the reaction mixture in case of silver turned from pale green to brown after 12 hrs, pale green to purple in gold nanoparticles. The reaction mixture exhibit an absorbance peak at 420nm and 560nm, characteristic of silver and gold nanoparticles respectively, due to its longitudinal plasmon vibration and due to different shapes of spherical or roughly spherical gold and silver nanoparticles. Transmission electron microscopy (TEM) divulge that gold and silver nanoparticles are quite polydispersed and ranged in the size from 20nm to 50nm and 20nm to 100nm, with an average size of 38nm and 60nm respectively. X-ray diffraction (XRD) shows number of Braggs reflection, which perhaps due to the face centered cubic structure of the crystalline gold and silver nanoparticles. TEM and Fourier transform infrared spectroscopy (FTIR) analysis reveals that silver nanoparticles are capped. Silver nanoparticles confer antibacterial activity against *Escherichia coli* (ATCC 8739), *Staphylococus aureus* (ATCC 6538p), *Pseudomonas aeruginosa* (ATCC 9027) and *Klebsiella pneumoniae* (clinical isolate). The move towards extracellular synthesis using dried biomass appears to be cost effective, ecofriendly to conventional method of nanoparticles synthesis.
Keywords: Extracellular synthesis; silver nanoparticle; gold nanoparticle; *Vitex negundo* Linn.; antibacterial; TEM; FTIR; XRD.

OP-14

BIOSYNTHESIS OF SILVER NANOPARTICLES BY USING *PHOMA HERBARUM* AND THEIR ACTIVITY AGAINST HUMAN PATHOGENIC BACTERIA

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Extracellular biosynthesis of silver nanoparticles by *Phoma herbarum* (MTCC-2548) is being reported in the present study. The fungal filtrate showed change in color, due to the excitation of the surface plasmon vibration. Further characterization for production of silver nanoparticles was evidenced by UV-Vis spectrum, showing the absorbance at 420nm (Perkin Elmer Lambda-25). The Fourier Transform Infrared Spectroscopy (FTIR) study reveals the presence of protein cap to the silver nanoparticle, which leads to increase stability of silver nanoparticle in the colloid. X-ray diffraction (XRD) analysis shows number of Bragg's reflection, which are due to the face centered cubic structure of the crystalline silver nanoparticles. Transmission Electron Microscopy imaging showed the presence of polydispersive and spherical silver nanoparticles in the range of 5-35 nm with average diameter of around 15.12 nm. Biosynthesized silver nanoparticles showed efficient antibacterial activity against human pathogenic bacteria. The maximum antibacterial activity was shown against *Escherichia coli* (Increase fold area - 3.06) followed by *Staphylococcus aureus* (2.78) and *Pseudomonas aeruginosa* (1.21).
Extracellular method for synthesis of silver nanoparticles was found to be simple, easy and ecofriendly.
Keywords: Phoma herbarum, Silver nanoparticles, FTIR, TEM, Antibacterial activity.

OP-15

SYNTHESIS AND CHARACTERISATION OF ZINC OXIDE BASED NANOFLUIDS WITH STABILITY, PH AND VISCOSITY RELATIONSHIPS SUBJECT TO HEATING AND COOLING CYCLES

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The exceptional heat transfer characteristics of nanoparticles' dispersion commonly known as nanofluids has given rise to a new impetus to research in heat transfer fluids. Huge consumption of water as coolant in steel industries has made people to think of new coolants with improved heat transfer properties. In this research, we have attempted to optimize the stability of Zinc Oxide(ZnO) Nanofluid(NF), which shows the maximum increase in thermal conductivity of water as per the U.S. patent(US 7,390,428 B2) , and further investigated the effect of temperature on its viscosity. ZnO Nanoparticles, size between 50 to 80nm, was dispersed in tap as well as DM Water using sodiumhexametaphosphate(NaHMP) as dispersant. Characterisation of Zinc Oxide Nanoparticles was done using SEM, XRD and FT-IR. The stable suspension in tap water had NaHMP:ZnO as 1:2,1:3 and 1:4 and 1:2, 1:3, 1:4 and 1:6 in DM Water respectively. The measurement of NF's dynamic viscosities was done using Vibro Viscometer and data were collected from temperatures ranging from ambient to 75°c. The results show that in the absence of dispersant, the NF shows hysteresis property which is arrested in the presence of dispersant in DM Water. The pH change in DM water showed similar characteristics, thus emphasizing the fact that it may be the base fluid viz. DM water which imparts Hysteresis(1) in properties of NF rather than the Zinc oxide nanopowder.

Keywords: Nanofluid, Zinc Oxide Nanofluid, Hysteresis

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OP-16

SYNTHESIS AND APPLICATIONS OF MAGNETIC NANO PARTICLES

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The synthesis of magnetic nano particles by various chemical routes is one of the interesting areas of research due to their versatile and commercial importance. Here, we will report a biological route for the synthesis of magnetic nanoparticles and its applications in fields like the Li ion batteries, bacterial detection and in the development of anti microbial,corrosion paints. We exploited the phytochemical properties of green plants like tomato, black grapes as this is a much safer route compared to the harsh chemical reduction reported in literature. The phytochemical like polyphenols, terepenes act as reducing agents and carbohydrates, flavinoids as shape and size stabilizers. We will demonstrate applications in the development of SPION (superparamagnetic iron oxide nanoparticles) based paint composites with epoxy resin which exhibits enhanced antimicrobial and anticorrosive with respect to the convectional epoxy coating methods. Moreover, single step detection of pathogenic bacteria content in the Bovine serum has been also demonstrated as a radical application of surface functionalized nanoparticles.

OP-17

SYNTHESIS OF NANO-MAGNETS IN MAGNETIC BACTERIA

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These days in biomedical technology, directed and controlled motion of micron sized objects in fluid systems is an active area of research. Magnetotactic bacteria (MTB) are motile, mostly aquatic prokaryotes, the hallmark feature of MTB is presence of unique intra-cellular crystals known as magnetosomes. These magnetosomes are magnetic iron mineral particles enclosed within membrane vesicles. They are made of magnetite (Fe_3O_4), iron sulphite, magnetosomes, containing greigite (Fe_3S_4) crystals. Mineral composition of magnetosomes is under strict chemical control. Magnetosome crystals are typically 35 – 120 nm long and 40 – 42 nm thick, showing three crystal morphologies; Cuboidal, Elongated Prismatic and Tooth Bullet. In both type of crystals, magnetic remence is less than that of single magnetic domain(SD) crystals. Crystal formation takes place through biomineralization which is a highly controlled and precise process. This is influenced by oxygen concentration and presence of nitrogen oxides. Steps involved in magnetosome formation: iron uptake by cells, vesicle formation, iron transport and controlled biomineralization. Studies using electron microscopy show that crystals of Fe_3O_4 of various sizes are being developed in various stages of maturity and crystals increase in size within magnetosome vesicles. This can be explained with Fe(II) and Fe(III) uptake in MTB. It was seen during vesicle formation, a lipid bi-layer membrane originates from cytoplasmic membrane, called a magnetosome membrane. Inside these vesicles, Fe(II) is reoxidized to Fe(III) oxides and in the final step, one-third of Fe(III) in hydrous oxides is reduced, on further degradation Fe_3O_4 is produced. These are the nano-sized crystals called Magnetosomes. The crucial step in transformation of hydrous iron oxide to magnetite in-vitro involves adsorption of Fe(II) on surface of hydrous iron oxide. The application of nano-magnets outside environment of the cell is extended to use for immobilizing enzymes and antibodies, with potential use as a contrast agent for MRI and tumor-specific drug carriers based on intratumoral enrichment.

OP-18

INVIVO TOXICOLOGICAL EVALUATION OF SILVER NANOMATERIAL

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Nanotechnology and materials science have progressed by leaps and bounds. Engineered nanomaterials (NMs) have been mass produced and widely applied. The innovative properties of the NMs have already found their first commercial and emerging biomedical applications. Despite the rapid progress and early acceptance of nanobiotechnology, the potential for adverse health effects due to short and long term exposure to non-target organisms has not yet been established. Although little is known about NM toxicity, oxidative stress, which elicits a wide variety of cellular events, such as apoptosis, cell cycle arrest and the induction of antioxidant enzymes, has often been reported as NM-induced toxicity. Several studies with regard to NMs toxicity, in various cell types and various NMs, have been reported that oxidative stress is one of the most important toxicity mechanisms related to the exposure to NMs. Of the various manufactured NMs, Silver Nanoparticles (SNP) have gained much popularity recently owing to the broad spectrum of antimicrobial activity, wound dressings, contraceptive devices, surgical instruments apart from these SNP are used in water purification, indoor air quality management. Thus, SNP is becoming more and more wide spread use in medicine and related applications. Such increasing exposure poses toxicological and environmental issues which need to be addressed. Very few reports on the toxicity of SNP are available. Our study aims to unravel the cellular events that occur upon exposure to SNP (35 nm) by examining oxidative stress parameters (Viz, lipid peroxidation, reduced glutathione, glutathione S transferase, Catalase, etc.,) in albino Wistar rats. The implications of the study will be discussed.

OP-19

BIOSYNTHESIS OF SILVER NANOPARTICLES USING PHYLLANTHUS NIRURI EXTRACT AND THEIR APPLICATION TO STUDY THEIR ANTICANCER ACTIVITY (HEPG2) AND ANTIMICROBIAL ACTIVITY

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A biological synthesis of silver nanoparticles was carried out using Phyllanthus niruri extract in presence of ammoniacal silver nitrate at room temperature. The rate of reduction of silver nitrate was tested at different concentration of silver nitrate in constant volume of plant extract. Similarly the influence of the plant extract concentration on rate of formation of silver nanoparticles was also investigated. The size and shape of nanoparticles were analyzed using High resolution Transmission electron microscopy (HRTEM). Nanoparticles were characterized with the help of UV- Visible absorption spectroscopy, Fourier transform infra-red spectroscopy (FT-IR), X-ray diffraction analysis. Further the antimicrobial activities of nanoparticles were investigated against various stains of Gram positive and Gram negative organism and also studied anticancer activity of HEPG2 (Hepatocellular carcinoma).This approach of the biosynthesis of nanoparticles is simple, amenable for large scale commercial production and biological application.

OP-20

CYTOTOXICITY AND FLUORESCENCE STUDIES OF SILICA OVER COATED CDSE QUANTUM DOTS FOR BIOIMAGING APPLICATIONS - A PRELIMINARY STUDY.

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Semiconductor quantum dots offer numerous applications in biomedical science, particularly for the detection of ions and molecules, drug and gene delivery, cellular imaging, diagnosis of diseases and therapy. Compared to organic fluorophores, quantum dots possess unique features such as broad absorption band, high two photon absorption cross section and narrow emission bands with high tunability as function of size, long lived luminescence etc. Here we have investigated the toxicological effects of silica overcoated CdSe quantum dots (CdSe-si) on human cervical cancer cell line (SiHa). Trioctylphosphine oxide (TOPO) capped CdSe quantum dots were synthesized and rendered water soluble by overcoating with silica, using aminopropyl silane (APS) as silica precursor. Overcoating with silica shell prevents escape of the core constituents, thereby decreasing toxicity effects and also making QD surface cytocompatible. The cytotoxicity studies were conducted by exposing cells to freshly synthesized silanised quantum dots as a function of time (0-12, 24, 48, 72 h) and quantum dots concentration up to 1 μM (250, 500, 750, 1000nM) by MTT assay, trypan blue dye exclusion method and morphological examination of cells using phase contrast microscope. The *in vitro* analysis results showed that the silica overcoated quantum dots were nontoxic even at micro molar concentrations. Subsequently the *in vivo* fluorescence was also demonstrated by injecting these quantum dots (5nM in 100uL) through the tail vain of Swiss albino mice. The fluorescent images in the cryosections of the liver tissue depicted strong luminescence property of silanised quantum dots under biological conditions. These results confirmed the possible role of CdSe-si quantum dots in biological labeling and imaging applications.

OP-21

BIODISTRIBUTION AND TOXICITY EVALUATION OF GOLD NANOPARTICLES IN SWISS ALBINO MICE

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Gold nanoparticles offer a great potential in the treatment and diagnosis of cancer. Understanding the interactions between nanoscale objects and living systems is of great importance for the diagnostic and therapeutic applications of nanoparticles and for nanotoxicology studies. This study was undertaken to address the biological interactions of gold nanoparticles in swiss albino mice. Here we report the tissue distribution and toxicity evaluation of Gold nanoparticles (AuNPs) on *in vivo* experimental models. Triethylene glycol capped gold nanoparticles were administered intravenously through tail vein into Swiss Albino mice. The animals were euthanised at different time intervals after AuNP injection and organ distribution of AuNP was determined using ICP-AES analysis and TEM. Toxicity evaluation was carried out at different time intervals by evaluating the markers such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), Alkaline phosphatase, Lactate dehydrogenase and Creatine kinase. Histopathological studies were also carried out on tissues of AuNP treated animal. For determining whether any genotoxicity during AuNP exposure, comet assay was done. The results were compared with control untreated group. This study revealed the compatibility of AuNPs in animal systems and concluded that these particles are non-toxic in animal systems and can be used for future clinical trials.

OP-22

GENOTOXIC EFFECT OF DIFFERENT SIZES OF NANOSILVER ON HUMAN LYMPHOCYTE: A PRELIMINARY REPORT

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Nano-silver is being used in a wide range and number of products. The widespread application has raised concern since little is known about the potential risks of nano-silver. In this study we primarily aim to identify any possible genotoxicity of two different sizes of silver- nano particle in human lymphocyte. Comet parameters (% tail DNA and Olive tail moment (OTM)) show significant extent of genotoxic response at nanosilver (≤100 nm) treatment concentration of 250 μM only, followed by no significant genotoxic response upto treatment concentration upto 2mM. Treatment with nanosilver of size ~20 nm showed dose response with significant extent of genotoxicity being observed at the highest doses. The irregularity in dose response could however be owing to formation of agglomerates with increase of treatment concentrations.

OP-23

GENOTOXICITY INVESTIGATIONS OF ALUMINIUM OXIDE NANOMATERIALS OF 30 NM AND 40 NM.

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Al_2O_3 nanomaterials (NMs), that constitute ~20% of the 2005 world market of NMs, are used as drug delivery systems, nanocomposites, abrasives, wear resistant coatings, in rocket fuels etc. The aim of the present work was to study whether Al_2O_3 30 nm and Al_2O_3 40 nm could cause potential genotoxic and mutagenic effects. Characterization of Al_2O_3 30 nm and Al_2O_3 40 nm was done prior to the main study. The genotoxicity of Al_2O_3 30 nm, Al_2O_3 40 nm and Al_2O_3 bulk was evaluated in female Wistar rats using the micronucleus test, chromosomal aberrations assay and comet assay in different rats' tissues. Moreover, mutagenicity of Al_2O_3 30 nm, Al_2O_3 40 nm and Al_2O_3 bulk was also assessed by the Ames test in different *Salmonella typhimurium* strains with or without S9 mixture. Our findings showed statistically significant size and dose dependent genotoxicity of Al_2O_3 30 nm and Al_2O_3 40 nm studied with micronucleus test, chromosomal aberrations assay and comet assay compared to the Al_2O_3 bulk and control ($P < 0.05$). Nonetheless, Al_2O_3 30 nm and Al_2O_3 40 nm did not reveal any significant size or concentration dependent mutagenicity in different *S. typhimurium* strains tested with and without S9 mixture compared to the Al_2O_3 bulk and control. Therefore, our study elucidated size and dose dependent genotoxic effects of Al_2O_3 30 nm and Al_2O_3 40 nm in rats, however, they were devoid of mutagenic effects in different *S. typhimurium* strains with or without S9 mixture.

OP-24

INVIVO TOXICITY OF TITANIA NANO PARTICLE INTERACTION WITHIN *DANIO AEQUPINNATUS*(GIANT ZEBRA FISH)

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TiO_2 is vital Nano Particle and is used in a wide range of consumer products, thereby increasing the occupational and other environmental exposure to humans and other species. One of the possible mechanisms associated with nano particle toxicity is reactive oxygen species (ROS).

The study is designed to characterize the particles and to look at the particle induced oxidative stress and cellular uptake of particles using Zebra fish on treatment with model TiO_2 particles.

The effects of TiO_2 were assessed *in vivo* using the zebra fish 3-6 months old adult as a model organism for nano toxicology evaluations in two groups (24hr, 48 hr). The surface studies were done by using TEM and characterized by using XRD techniques for confirmation of the grain size which is <100 nm. Muscle, Liver, Brain and Gills tissues were analyzed with 20 ppm concentration. Protein, LPO, GPx,, SOD, Catalase and DNA fragmentation were estimated.

The grain size of TiO_2 is < 100nm confirmed by XRD, SEM and TEM.A significant increase in lipid peroxidation and liver marker enzymes like ALT, AST accompanied with an increased activity of antioxidants like SOD, Catalase, GPx, were observed was due to TiO_2 induced oxidative stress in experimental animals. Histopathological examination of TiO_2 administrated groups shows cellular damage and DNA damage was confirmed by modified comet assay. Inductively Coupled Plasma optical emission spectrophotometric analysis confirmed the presence of nanoparticles in the tissues DNA. It is evident due to reduce antioxidant activity and results in increased apoptosis

Keywords : TiO_2 nanoparticle, Zebra Fish, Toxicity

OP-25

A NOVEL METHOD FOR TRANSFORMATION OF *ESCHERICHIA COLI* CELLS BY PLASMID DNA USING CALCIUM PHOSPHATE NANOPARTICLES

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In the field of genetic engineering, transformation experiment is routinely carried out in different laboratories with an aim to introduce foreign DNA in *Escherichia coli* (*E. coli*) cells. The steps of standard transformation procedure are: 1) freshly grown cells are first suspended in ice-cold 100mM calcium chloride and kept at 0^0C for 30 minutes to make the cells competent for DNA uptake; 2) plasmid DNA is then added to the competent cells and stored at 0^0C for another 30 minutes to allow adsorption of DNA on cell surface; and 3) cells are then subjected to a heat-pulse from 0^0 to 42^0C for 90 seconds to facilitate entry of adsorbed DNA into cell cytoplasm. Here, we report about a new method of transformation using calcium phosphate nanoparticle (CPN) instead of $CaCl_2$. Compared to the widely used $CaCl_2$ method, ours CPN-mediated procedure requires lesser time, lesser steps (virtually one step) and so a simple process.

When freshly grown cells of *E. coli* are taken in a suspension of 12.5 mM CPN of size 90nm (instead of 100mM $CaCl_2$) and DNA is added to such cells, transformation occurs almost instantaneously; i.e., the incubation steps for competence development and DNA adsorption and the subsequent heat-pulse step of standard $CaCl_2$ procedure are not at all required in our method. Irrespective of the size of plasmid DNA as well as the strain of *E. coli* used, CPN-mediated transformation procedure works well.

OP-26

ENHANCED ANTIBACTERIAL ACTIVITY OF COPPER NANOPARTICLES STABILIZED IN GELATIN

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Among the most promising nanomaterials with antibacterial property, metallic nanoparticles (NPs) are well-known for increased bactericidal effect due to their large surface to volume ratio and crystallographic surface structure. The study of bactericidal NPs is particularly important at present due to increase of new resistant strains to the most potent antibiotics. We prepared copper NPs in gelatin medium by a simple reduction process and characterized by UV-spectrophotometry, XRD and TEM. This unique preparation technique enabled the synthesis of highly stabilized metallic Cu-NPs that can be used in open air.

To examine the antibacterial effect, *E. coli* was taken as a model bacterium. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) to our copper NPs were found to be 4 and 8μg/ml respectively, which were much lower than the values reported previously with Cu-NPs prepared by other methods [1, 2]; at a concentration of 16 μg/ml, all the cells were killed. Bacterial sensitivity to NPs, as observed from the susceptibility constant, was calculated to be 0.5, which was also much higher than the previously reported value [2]. The antibacterial activity had also been demonstrated by FACS using propidium Iodide as marker dye. Phage contrast microscopic study showed that cell filamentation had occurred by the NPs and the more was the concentration of NPs, the more was the population of filamentous cells; filament size varied from 3 to 19.5 μm compared to the normal cell size of 2.5 μm. Elaborate molecular mechanistic study is going on in our laboratory.

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OP-27

IN VITRO AND IN VIVO TOXICITY STUDY OF SILVER-25 NANOPARTICLE TREATED MICE WITH SPECIAL REFERENCE TO OXIDATIVE STRESS RELATED GENE EXPRESSION

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Nanoparticles have recently received great deal of attention due to their novel physicochemical characteristics and functions. Nanoparticles are small scale substances (<100 nm) useful in many fields ranging from biomedical applications, electronics, and energy production. This elicits concern for their toxicity due to the increased exposure during large-scale industry production. In the present study the effects of silver-25 (Ag-25) nanoparticles on the brain were evaluated *in vivo* and *in vitro*. *In vitro* exposure to Ag-25, using a mouse brain homogenate preparation, produced dose-dependent increases in ROS production which were significant at concentrations of 60, 80 and 100 µg/ml Ag-25. A 3.5-fold increase in ROS production was observed after treatment with 100 µg/ml Ag-25. Dose finding studies indicated no toxic symptoms or mortality in mice treated with 100 mg/kg Ag-25, whereas, 50% mortality was observed within 5 days in mice treated with 1000 mg/kg Ag-25, and 100% mortality was observed within 24 hrs with 2000 mg/kg Ag-25. Therefore, mice were administered 1000 mg/kg Ag-25 (i.p.) and sacrificed after 0.5, 1, 2 or 4 hrs. *In vivo* exposure to Ag-25 produced a 3-fold significant increase in ROS production in the brain after 1 hr, whereas at 0.5, 2 and 4 hrs ROS was nearly equal to control values. These data suggest that Ag-25 nanoparticles may produce neurotoxicity both *in vitro* and *in vivo* by generating free radical-induced oxidative stress. In addition, we performed RT-PCR analysis in mice treated orally with 100, 500 and 1000 mg/kg doses using Mouse Oxidative Stress and Antioxidant Defense microarrays. The results revealed that the expression of genes varied in the caudate nucleus, frontal cortex and hippocampus of mice treated with Ag-25. In caudate nucleus, Ag-25 significantly up regulated 18 genes, whereas in frontal cortex 14 genes were significantly altered. However, in hippocampus 26 genes were significantly down regulated. These results suggest that Ag-25, by altering gene expression, may cause apoptosis and neurodegenerative disorders.

OP-28

EFFECTS OF STARCH (RICE-PORRIDGE) ASSISTED SYNTHESISED IRON OXIDE NANOPARTICLE ON TILAPIA (*Oreochromis mossambicus*): HAEMATOLOGY, ANTIOXIDANT ENZYMATIC ACTIVITY, AND HISTOPATHOLOGY

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Toxicity tests were performed to investigate possible harmful effects on Tilapia (Oreochromis mossambicus) exposed to starch assisted synthesized iron oxide nanoparticle (Rice-porridge as starch). The significant changes in hemoglobin, RBC count and total WBC count were observed in adult tilapia. The disturbance of the antioxidative balance was observed during the early exposure period based on the monitoring of the liver and brain catalase, superoxide dismutase (SOD) and reduced Glutathione (GSH). No terminal oxidative damage occurred during the whole exposure period. Some histopathological alterations were observed in gill and liver tissues, which confirmed that deleterious effects occurred as a result of direct contact with iron oxide nanoparticle.

Keywords: Iron oxide nanoparticle, Nanotoxicity, Fish, Haematology, Antioxidant enzymatic activity and Hitopathology.

OP-29

POLYETHYLENE SEBACATE NANOPARTICLES: GENOTOXICITY , MUTAGENICITY EVALUATION AND APPLICATION IN DRUG DELIVERY

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Biodegradable polymeric nanoparticles are widely investigated as targeted intracellular delivery systems. Nanosize facilitates uptake into cells and transcytosis across epithelial and endothelial cells into the blood and lymph circulation to reach potentially sensitive organs such as bone marrow, lymph nodes, liver, spleen, and heart etc. This unique feature makes nanomaterials very attractive for drug delivery however; it might cause calamitous effects on cells and tissues. Intracellular, targeted biodegradable polymeric nanoparticles increase the risk of their interactions with cell organelles like DNA and chromosomes leading to genotoxicity and/or mutagenicity. The present study reports genotoxicity and mutagenicity evaluation of biodegradable polyethylene sebacate nanoparticles (PES NPs) as a strategy to ensure safety as nano drug carrier and development of PES rifampicin(RF) for intracellular delivery. PES NPs were characterized for particle size and shape by photon correlation spectroscopy and transmission electron microscopy. Genotoxicity of PES NPs was evaluated *in vivo* using standard battery of tests namely micronucleus test, chromosomal aberration and comet assay. Cyclophosphamide was used as positive control. Mutagenicity was assessed at six different concentrations by *in vitro* Ames II test. PES NPs were found to be nongenotoxic and nonmutagenic and hence used for development of PES RF NP for intracellular delivery of RF. PES RF NP showed very high %EE (Entrapment Efficiency,84.12 %), average size of 384 nm (PDI = 0.214) and sustained release. Based on freeze thaw study 10% trehalose was used for the freeze drying. Freeze dried PES RF NP showed good stability over a period of three months. The nongenotoxic and nonmutagenic properties suggest PES as safe carrier for intracellular drug delivery.

OP-30

SOLUBILIZATION OF TIO_2 NANOPARTICLES UNDER INVITRO CONDITION: IMPLICATION FOR TOXICOLOGICAL STUDIES

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Abstract: Nanotoxicology is an emergent discipline due to the safe developments of nanotechnology and for the increased handling of nanoparticles (NPs). Titanium dioxide (TiO_2) NPs are used in various applications including the fabrication of paints, paper, cosmetics, pharmaceuticals, plastics, food additives and in several other manufactured products. Since aquatic resources are the ultimate dumping ground present study was focussed on the TiO_2 NPs in the aquatic organism a fresh water fish *Mystus vittatus* as a model organism. In the experimental fish alterations of antioxidant enzymes were assessed. The results reveals that the antioxidant enzymes levels were significantly reduced in the treated animals ($P<0.05$). This study explores the alteration of antioxidant enzymes due to TiO2 NPs can be considered as a biomarker to TiO2 mediated oxidative stress in fish sample.

Key words: : Titanium dioxide nanoparticles ;ROS ; Toxicological effect; Oxidative stress.

OP-31

INFLUENCE OF ORAL ADMINISTRATION OF ZINC OXIDE NANOPARTICLE IN THE AQUATIC ANIMAL *OREOCHROMIS MOSSAMBICUS*

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The environment exerts its impacts on the physiology and psychology of animals in a wide variety of ways. It could be understood by exposing different environmental factors that affects different processes, based on which predictions can be made on these changes in order to avoid or moderate deleterious events in fish health. In this experiment the zinc oxide nanoparticle was administered orally at different concentration to *Oreochromis mossambicus* and the effects were studied through haematological parameters and antioxidant enzymes activity. The treated animals showed significant variances in the above parameters than the control. The results evidenced that the zinc oxide nanoparticle can influence the aquatic animals physiology such as haematology and enzyme activity.

Keywords: Zinc oxide nanoparticle, haematology, antioxidant enzyme, aquatic environment, oxidative stress

OP-32

GENOTOXICITY OF MATERIALS AT THE NANO LEVEL

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The technology aimed to conceive, characterize and produce materials at nanometer scale is called Nanotechnology. It represents the fastest growing areas of scientific research. Nanomaterials (NMs) have specific physico-chemical properties different to bulk materials of the same composition and such properties make them very attractive for important applications in a wide variety of areas. However, NMs may act on the living cells at nano level resulting not only in biologically desirable, but also undesirable effects. Though many effects have been aimed at exploiting beneficial properties of NMs for various purposes, there are limited attempts to evaluate the probable ill effects of these materials. Therefore, it is necessary that the safety of newly synthesized NMs and the factors that influence their associated hazards are understood. An important area governing regulatory health risk assessment is genotoxicity. It is a study of genetic damage following treatment with test samples. It is a vital part of regulatory norms as damage to the genome may promote carcinogenicity or have an impact on reproduction. Hence, the goal of the current presentation is to provide an update of the toxicological developments in the field of nano genotoxicity.

OP-33

MYCOSYNTHESIS OF SILVER NANOPARTICLES USING DIFFERENT *FUSARIUM* SPECIES FOR THE DEVELOPMENT OF NOVEL ANTIMICROBIALS

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In this study, screening of different *Fusarium* species was carried out for the extracellular synthesis of silver nanoparticles. Up till now 13 different *Fusarium* species viz. *Fusarium acuminatum* (DBT-1), *F. proliferatum* (DBT-5), *F. solani* (DBT-8), *F. scripi* (DBT-14), *F. semitectum* (DBT-15), *F. equiseti* (DBT-20) (isolated from infected plant materials), *F. graminearum* (MTCC-1893), *F. poae* (MTCC-2086), *F. moniliforme* (MTCC-1848), *F. culmorum* (MTCC-2090), *F. tricinctum* (NCIM-1190), *F. chlamydosporum* (MTCC-2099) and *F. oxysporum* (NCIM-1072) were screened. All these species have potential for the production of silver nanoparticles. Detection and characterization of synthesized silver nanoparticles was carried out by visual observation, UV-Vis spectroscopy, FTIR and TEM analysis. All these analytical methods confirmed the extracellular synthesis of silver nanoparticles. From the TEM micrograph images it was reported that the synthesized silver nanoparticles were spherical and polydispersive having size range of 5-80 nm.

The biosynthesized silver nanoparticles were screened for their antibacterial potential. Human pathogenic and multidrug resistant bacteria like *Staphylococcus aureus*, *S. epidermidis*, *Salmonella typhi*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, etc. were more sensitive to the silver nanoparticles than the commercially available antibiotics. Also the activity of these antibiotics was significantly increased in presence of silver nanoparticles.

The present work was carried out under the Scientific and Technological Cooperation Programme of DST-CNPq (Indo-Brazil joint research project).

Keywords: *Fusarium*, Extracellular, Antimicrobials, Nanoparticles, Human pathogenic bacteria, Nano-gel.

OP-34

MORTALITY AND CYTOTOXICITY ASSESSMENT OF SONICATED AND FILTERED FULLERENE (C_{60}) IN ASIAN SEA BASS *LATES CALCARIFER*

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The rapid growth of nanotechnology is inspiring research concerning the potential environmental impacts of manufactured nanomaterials. Mammalian and *in vitro* studies have raised concerns about the toxicity of fullerene nanoparticles (C_{60} NPs), but there are very limited data on ecotoxicity to marine aquatic life. The present study summarizes the potential toxicity of C_{60} nanoparticles prepared by sonication and filtration using THF on juveniles and sub adults of Asian seabass *Lates calcarifer* by 48 hr acute toxicity tests. The study also focused on oxyradical-induced lipid and protein damage and impact on total glutathione (GSH) levels .Exposure to sonicated and filtered nC_{60} caused mortality in both juveniles and adults. However filtered nC_{60} caused mortality at lower concentrations than sonicated nC_{60}. Biochemical analysis results also demonstrated an increase in hepatic GSH levels in fishes exposed to filtered C_{60} but in the gill and brain it was found to be decreased. Long term exposure studies are essential to predict the extent of physiological effects of this nanomaterial in marine environment.

Keywords : Fullerene , *Lates calcarife*r, Acute toxicity, Biochemical analysis.

OP-35

IN VIVO CHRONIC TOXICITY OF NANO TITANIUM DIOXIDE ON LIVER AND KIDNEY OF MICE

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In order to evaluate the toxicity of nano sized TiO_2 particles, we have chosen nano TiO_2 with size<100nm. Here a dose of 50mg/Kg body weight was intraperitonially injected into the abdominal cavity of albino male mice once in a week for 45 days and its potential toxicological effect on liver and kidney were investigated. The results showed the oxidative damage was induced in both the organs because the antioxidant enzyme levels such as catalase, SOD, GPX were highly regulated to counteract overproduced free radicals. The changes of liver parameters (ALT, AST, and ALP) and pathology like hydropic degeneration around the portal vein of liver indicated that the hepatic injury was induced after nano TiO_2 injection. In addition, the nephrotoxicity like pathology change of kidneys were also observed. Obvious Titanium accumulation, DNA fragmentation and lipid peroxidation were also observed in both kidney and liver. Overall, we conclude that accumulation of titanium dioxide nano particles in liver and kidney is a concern and its toxicity involves oxidative stress, organ pathologies and DNA fragmentation.

OP-36

ALGINATE/CHITOSAN NANOPARTICLES: GLUTATHIONE AND S-NITROSOGLUTATHIONE AND THEIR PREPARATION, CHARACTERIZATION AND NANOCYTOTOXICITY

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Nitric oxide (NO) is involved in several physiological processes, such as the control of vascular tone, the inhibition of platelet aggregation, smooth muscle cell replication, immune response and neuronal communication. Thus, there is a great interest in the development of NO-releasing drugs and in matrices which are able to stabilize and release NO locally in different tissues. Thiols, such as glutathione (GSH), are ready nitrosate to form the NO donors S-nitrosothiols (RSNOs). In this work, GSH was encapsulated into a mucoadhesive combination of alginate/chitosan. The encapsulated thiol was nitrosated leading to the formation of S-nitrosoglutathione (GSNO) in the alginate/chitosan nanoparticles. The GSNO-containing nanoparticles were characterized regarding their kinetics of NO release and cytotoxicity. The encapsulation of GSNO in the nanoparticles led to a stabilization of GSNO decomposition, compared to non-encapsulated GSNO. The cytotoxicity characterization of the nanoparticles containing GSH and GSNO showed similar results.These results show that this novel nanostructure biomaterial has potential to be use in biomedical applications where NO has a therapeutical effect.

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OP-37

PREPARATION OF CELLULOSE NANOFIBRILS BY MECHANICAL PROCESS AND ITS CHARACTERIZATION

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Nanofibrils obtained from cellulose are of huge interest due to their network formation characteristics. They impart enhanced mechanical strength when incorporated in polymer nanocomposites. Cellulose nanofibrils can be prepared by mechanical disintegration of cotton fibers. The present work involves kier boiling & bleaching of the raw cotton fibers for removal of noncellulosic materials followed by drying. The bleached cotton fibers were pretreated by passing through a lab disc refiner (Universal Refiners Ltd. India) up to 30 passes. The samples were analyzed after every five passes. The scanning electron microscopy analysis showed that with number of passes the percentage of fibrillation also increased. The diameter of the microfibrils was found to be reduced up to 100 nm from an initial diameter of 20 μm as analyzed by Scanning electron microscopy. X-ray diffraction study showed that crystallinity of the fibers reduced up to 65% after 30 passes from 81% after 5 passes. Energy required was measured using energy meter (Secure Meters Ltd) and for fibrillation of 10g cotton fibers energy required was 0.75 kWh. Further, fibrillated cotton fibers sample using refiner is passed through high pressure homogenizer (BEE International) for further fibrillation to take place.

OP-38

ELECTRON PARAMAGNETIC RESONANCE (EPR), OPTICAL ABSORPTION AND INFRA-RED SPECTRAL STUDIES BASICS AND APPLICATIONS TO MATERIAL, LIFE AND EARTH SCIENCES.

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Minerals, fossils and plant materials are naturally occurring solid compounds having definite composition and physical properties. Minerals are highly complicated inorganic substances which cannot be understood even when its complete chemical analysis is available. As a result of the synthesis of large single crystals, minerals have become available for use as lasers, piezo crystals and probing devices in scintillators, ferromagnetics, ferro elastics and accousto-optical instrumentation. In the case of grown crystals, transitions metal ions are deliberately doped into the particular host lattice and its study is also complicated. This complexity of behavior in natural inorganic compounds and their synthetic analogues gives scope to employ different techniques such as optical absorption, infrared (IR) and electron paramagnetic resonance (EPR) to understand their behavior.

Electron spectra of transition metal ions in these natural compounds and synthetically grown analogues can be studies both by optical, IR and EPR spectra. But in optical spectroscopy, transitions proceed between orbital levels, whereas in EPR spectroscopy they take place between spin sub levels emerging in the external magnetic field following splitting of the ground orbital state of the atom. Thus EPR spectroscopy is a natural sequel to optical spectroscopy. In EPR detailed nature of the ground state comes under consideration since only the spin degeneracy of the lower orbital state is more sensitive in these studies. Optical spectroscopy supports this EPR analysis and also gives information of the higher energy states. Thus optical absorption not only supplements but also complements the EPR results. The ligand structure around the metal ion in the compound could be explored by using infrared spectroscopy.

Free transition metal ions have unfilled d-shells and d-d transitions are forbidden. However, when the transition metal ions are embedded in crystal lattice, the degeneracy of the d- levels is removed and they split into various energies. The study of the nature of splitting and positions of the absorptions in EPR and optical spectra of the transition metal ions in solid state reveal the site symmetry of the transition metal ion and the nature of the surround ligands, and it also gives the oxidation state of the transition metal ion.

Using these techniques nano-structures could be explored. For instance manganese-zinc/aluminum doped ferrites have wide industrial applications such heat transfer devices, drug delivery systems and medical diagnostics. Spinels have applications in transformer, inductor, chokc coils, noise filters, magnetic recording heats etc., A few examples on copper, iron and manganese bearing systems will be discussed.

OP-39

PARTICLE SIZE DISTRIBUTION OF MINING MINERAL'S NANO-PARTICLES AND ITS SIGNIFICANCE IN CERAMICS.

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Forming process as well as firing process of ceramic preparation affects Particles Size Distribution of ceramics preparation affects, subsequently the ultimate properties of finished products. Mining minerals consists of Clay, Quartz and Feldspar etc. Among these feldspar acts as flux, clay provides plasticity, dry properties and Quartz acts as filler. The particles size distribution, degree of intermixing and physio-chemical characteristic of constituents affects the Pyro-chemical reaction. To determine the effect of particle size and physiochemical characteristics clay was prepared of size 200nm to 10nm particles by standard method. SEM technique was used for characterization and identification of nano particles. The physical properties of raw material of clay viz pH, specific gravities, liquid limit & plastic limit, water adsorption, loss on drying, residue on ignition, modulus of rupture (green and fired) linear shrinkage and whiteness, brightness and effect of fire on vitrification were carried out along with the physiochemical properties of final ceramic bodies viz effect of vitrification, whiteness, glassiness, mullite, war page and strength of final bodies were also carried out.

As the result assessed, it was observed that decreasing the particles size increases mullitation, vitrfication and comprehensive strength (MOR), whiteness. Besides this decrease in the particles size of mining minerals size also decreases the specific gravity of final ceramic body. Whiteness increases 90% to 94% for 2000nm to 100nm respectively. Water adsorption for 2000nm is 0.1% and nil for 1000, 500 and 100 nm particles size. Firing time reduces up to 10 minutes. Fire modules at 1250^0C of rupture, reduces up 64% and Fire shrinkage increases gradually with increasing particles size.
Finer quartz particle favor the formation of mullite.

OP-40

APPLICATION IF TITANIUM OXIDE NANO FLUID IN RAPID COOLING OF STEEL PLATE

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The quenching of different steel samples exposed to pure water and water-based nanofluid with Titania (TiO_2) nanoparticles at low concentrations (0.01 wt %) with the mixture of sodium hexa meta phosphate $(NaPO_3)_6$ (0.01 wt %) were acquired experimentally. The samples are heated in horizontal-tube furnace at a temperature of about 1000^0c for tem minutes. The samples were observed after polishing in SEM, optical microscope and micro hardness testing system . We found some interesting results ,the experiment shows at some extent it effects the process of quenching when it done in nanofluid than water. The hardness of some samples increases and some has very little effects . It shows a interesting result that we can get a wide range of steel using different nanofluids formed with different nanopowder for different purposes. The reason for the surface hardness is the formation of martensite phase during quenching. The nanofluid has little effect on TRIP steel as because the sample contains mostly martensite form . Some more test can verify that martensite formation increases due to nanofluids or not ,which will be done in future. If we use to hot the steel sample upto more than 1400^0c and quenched with nanofluid within a fraction of second than it also may give some fruitful results . If we check with silica(SiO_2),alumina(Al_2O_3),zinc oxide(ZnO) as nanopowder with some kind of dispersants with different wt % ratio between nanopowder and dispersant for the formation of nanofluid than it might give some interesting results .

DEVELOPMENT AND CHARACTERIZATION OF FUNCTIONALIZED CARBON NANO FIBERS, AN ADSORPTIVE MATERIAL FOR THE IN SITU REMOVAL OF PERSISTENT ORGANIC POLLUTANTS (POPS)

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Carbon nanofibers (CNF) were grown on micron sized activated carbon fibers (ACF) used as a substrate. A bed of ACF was first impregnated with the salt of nickel, which was then reduced to metallic nickel. Subsequently, the reduced sample was subjected to chemical vapor deposition to grow CNF at ~1023K using benzene as a carbon source. Functionalization of CNF was carried out by refluxing pyridine vapors through the packed beds of CNF at 393K. The surface properties of CNF were characterized by N_2 adsorption at 77K, XRD, FT-IR, CHNO, AAS and SEM etc. The SEM results showed the "hollow" CNFs with an average diameter of 30-40 nm and several micrometers in length. N_2 adsorption experiment indicated that the CNF array exhibited a high BET surface area of 925 m^2/g and has mainly microsoporousity. The adsorption of gaseous-phase 2-chloroethanol, a persistent organic pollutant on CNF was investigated by gas chromatography (GC) with flame ionization detector (FID). Functionalized CNF had a higher equilibrium adsorption capacity compared to the original ACF, ACF impregnated with metal, or CNF. From the chemisorption study, it was revealed that at relatively larger metal concentrations, the percent metal dispersion in the prepared adsorbents was small which decreased the active metal surface area and adsorption capacity. The surface functionalization by pyridine was shown to yield basic surface which enhanced the adsorption capacity. This study has significance because CNF array may be used as a real-time gas adsorbent for POPs.

Keywords: Activated carbon fibers, Carbon nanofibers, Adsorption, Persistent organic pollutants

OP-42

SELF-ASSEMBLED NANO FILM IN CORROSION PROTECTION OF COPPER FOR APPLICATION IN MICROELECTRONIC PACKAGING

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Copper metal is being explored for its use in microelectronic packaging. The advantage of lower resistance of copper is rapidly establishing itself as one of the materials for wire bonding and as an alternative to gold in microelectronic packaging. But, the problem of corrosion of copper is of main concern. Self-assembled monolayers (SAM) of organic molecules act as effective barriers and protect copper against corrosion. In the present paper corrosion protection of copper by self-assembled nanofilm of 1,2-dihydro-3-(octadecylthio) benzotriazine (DOTBT) is presented. The optimum conditions for formation of DOTBT SAM on etched copper surface have been established using electrochemical impedance studies. The DOTBT SAM on copper surface was characterized by contact angle measurement, X-ray photo electron spectroscopy, FTIR reflection absorption spectroscopy and atomic force microscopy. Corrosion protection ability of DOTBT SAM was evaluated in an aggressive corrosive environment like aqueous HCl using impedance, electrochemical quartz crystal nanobalance, potentiodynamic polarization and cyclic voltammetry studies. While bare copper showed a charge transfer resistance (Rct) value of 0.64 $k\Omega\ cm^2$ in 0.20 M HCl environment, the Rct value for the DOTBT SAM modified copper surface is as high 198.7 $k\Omega\ cm^2$. The DOTBT SAM on copper afforded an inhibition efficiency of 99.6 – 89.7% in HCl environment in the concentration range and temperature range studied. The results showed that the prefilmed copper with DOTBT SAM might find application in microelectronic packaging. Quantum chemical calculations showed that DOTBT has a large –ve charge in its triazine ring, which facilitates formation of a polymeric [Cu^+ - DOTBT] complex. The mechanistic aspects of corrosion protection of copper by 1,2-dihydro-3-(octadecylthio) benzotriazine nanofilm are discussed.

OP-43

PATENT RESEARCH ON GRAPHENE AND RELATED APPLICATIONS

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The most widely studied nanomaterials are carbon nanotubes, graphene, quantum dots and fullerenes. Among these materials, graphene is the cheapest to produce and is the most suitable for applications such as sensors, solar cells, coatings etc.

A study of the patent literature on applications of graphene has been conducted with an aim to identify novel applications, major patent filers and recent research trends in this area. A global patent search has been conducted on paid databases using appropriate search strategies and specific classification codes. Based on the results of the patent search, GSI Creos Corporation, William marsh Rice University, Samsung Electronics, and Canon have been identified to be among the major patent filers in this area. There also appears to be an increased research interest in this area with new players stepping up their research efforts. The study identifies academic institutes and independent inventors whose patents can be considered for potential licensing. The commercial markets being eyed by companies through their global filings and the most highly cited patents have also been presented.

The patent research uncovers novel applications for graphene in areas such as coatings on medical devices, aerospace applications and cosmetics.

Keywords: Graphene, Nano-materials

ABSTRACTS

(POSTER PRESENTATIONS)

PP-01

FERRIC IMPREGNATED SILICA NANOPARTICLES AS MATRIX FOR ENZYME IMMOBILIZATION AND BIOCATALYTIC ACTIVITY EVALUATION

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In biotechnology sector, immobilization of enzymes onto insoluble supports has been a topic of active research in enzyme technology and is an important tool for their application to industrial processes, fabrication of a diverse range of functional materials or devices The recent development in this sector is use of nanosize materials as supports for whole cell or enzyme immobilization mainly to enhance the surface area to accommodate more immobilization material in a unit area. Among these materials magnetic nano particles are very popular when used in conjunction with biological materials like proteins, peptides, enzymes, antibodies and nucleic acids because of their unique properties. The magnetic-ion impregnated silica base provides a good degree of biocompatibility and a high specific area whose rich chemistry allows easy functionalization and immobilization of biomolecules

In the present study the impact of ferric impregnated silica nanoparticles (FSP) and their use as matrix materials for enzyme immobilization was evaluated. The nature of ferric species (Fe^{+3}) in F-SP was confirmed by X-ray diffraction (XRD) and FT-IR studies. Diastase enzyme was immobilized onto different sizes of FSP, and its presence was characterized by XPS. The effect of size of FSP reflected with enzyme binding and its biocatalytic behaviour. The experimental results suggested that enzyme catalytic properties (Km, Vmax and activation energies) differ with the size of matrix materials. Analysis of enzyme binding nature with these nanoparticles revealed that binding pattern and activity profile varied with the pH of the reaction mixture. Reusability studies indicated that this EI-FSP could be used more than 50 cycles without any significant loss in activity.

PP-02

SYNTHESIS OF SILVER NANOPARTICLES USING GUM KONDAGOGU (*COCHLOSPERMUM GOSSYPIUM*)

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Nanoparticles of noble metals in general, have gained importance due to their distinctive functionalities that are related to physical properties such as size, shape and inter-particle spacing. Antimicrobial activity of silver nanoparticles is of interest, as the development of silver resistance in microbes is improbable due its action on broad spectrum of targets in the cell. Currently, various synthetic schemes have been explored for the production of silver nanoparticles. In this context, a facile and ecofriendly green method has been developed for the synthesis of silver nanoparticles from silver nitrate using gum kondagogu (*Cochlospermum gossypium*). This biopolymer is a rhamnogalacturonan type of natural gum produced as an exudate by the tree. Earlier studies have established that gum kondagogu to be non-toxic and have a potential application as food additive and drug delivery matrix. The synthesized nanoparticles were characterized using UV- Vis spectroscopy (UV-Vis), Transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR). The antibacterial activity of the prepared silver nanoparticles was tested on Gram-positive and Gram-negative bacteria by well diffusion technique. The synthesized silver nanoparticles had significant antimicrobial action on both the Gram classes of bacteria. Hence, this biopolymer based silver nanoparticles may find potential applications in the development of antimicrobial formulations such as hydrogels, wound dressings, water filters, medical devices etc.

PP-03

CORE–SHELL NANOGELS FOR THERAPEUTIC PROTEIN AND SUICIDE GENE DELIVERY

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Biodegradable polymers have an important role in sustained delivery of drugs and biomolecules. Currently investigated biodegradable polymers have disadvantages in lack of response to the physiological changes like, pH and temperature (1). To address this problem "stimuli sensitive" polymers, such as N-isopropylacrylamide (PNIPAM) and chitosan (CS) have gained much attention for biomedical applications (2). In the present work, thermo and pH responsive PNIPAM/CS core–shell nanogels were synthesized. The morphology and the composite structure of the nanogels were characterized by atomic force microscope (AFM), Fourier transform infrared spectroscopy (FTIR) and X-ray powder diffraction (XRD) techniques. We have persuaded the release kinetics of the core shell nanogels using green fluorescence protein (GFP) as a model protein. We could easily detect *in vitro* GFP release by measuring fluorescence, because, initially GFP fluorescence was quenched by acrylamide inside the core shells. We are evaluating toxicity of these nanogels for their potential application in delivering therapeutic protein and cytosine deaminase suicide gene.

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PP-04

"GREEN" SYNTHESIS AND CHARACTERIZATION OF GOLD NANOPARTICLES USING A NATURAL BIOPOLYMER- GUM KONDAGOGU (*COCHLOSPERMUM GOSSYPIUM*)

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Gold nanoparticles were synthesized and characterized, based on green synthesis route using gum kondagogu (*Cochlospermum* gossypium)- a hydrogel as a dispersant and a reductant. The resultant gold -gum kondagogu hydrogel network was highly stable and uniformly distributed without undergoing any oxidation. Gold-biopolymer nano-composite was characterized by, UV-vis spectroscopy, FT-IR, SEM-EDXA, XRD and TEM analysis. The formation and stability of gold nano-particles in hydrogel was confirmed by UV-vis spectroscopy, Fourier transform infrared (FT-IR) spectroscopy and X-ray diffraction (XRD) analysis. Transmission electron microscopy (TEM) results demonstrate that gum kondagogu hydrogel had a regulated size (5-20 nm) of gold nanoparticles. Hydroxyl groups present in gum kondagogu were involved in the gold bioreduction. Metallic gold was detected as micro-precipitates on the surface of gum kondagogu and in colloidal form as nanoparticles in the solution. The present results demonstrate that naturally occurring gum kondagogu can be used as a non-toxic reductant for nano-particulate construct in the production of gold-nanoparticles and offers numerous benefits ranging from environmental safety to ready integration of these nano-materials to biologically relevant systems, catalysis, DNA sequencing recognition, biosorption and other biomedical applications.

PP-05

PREDICTED DRUG DELIVERY SYSTEM WITH NANOENGINEERED IMPROVEMENTS BASED ON STRUCTURAL ANALYSIS OF BESTROPHIN

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Best Vitelliform macular dystrophy is a progressive autosomal dominant disorder with juvenile onset that causes loss of visual acuity due to atrophic macular changes or choroidal neovascularization associated with sub retinal hemorrhages and fibrosis. This disease is caused by mutations in *VMD2* gene. The gene product of *VMD* Bestrophin is a plasma membrane protein with transmembrane spanning helical domains. Bestrophin is found in a thin layer of cells at the back of the eye called the retinal pigment epithelium (RPE) which involves in the normal function of specialized cells (photoreceptors) that detect light and color.

Understanding the function of Best-1 and how mutations in the protein cause disease is essential to developing treatment strategies for BMD. Structural information can provide insight into protein function, and therefore, high-accuracy prediction of protein structure from its sequence is highly desirable.

The detailed analysis of the protein structure is required to understand the molecular function of the protein and the disease caused by the protein. Hence the protein is analyzed through various Bioinformatics tools. The main objective is to identify a probable drug for the disease via the Docking studies and deliver the drug by Micelle Drug Delivery system.

Keywords: VMD, Bestrophin, Docking, Micelle

PP-06

SCREENING AND DETECTION OF ORAL CANCER PROTEIN MARKER IN SALIVA

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Oral cancer is one of the ten most prevalent cancers in the world. The prognosis and early diagnosis for oral cancer is notably poor. The incidence of cancer in the oral cavity appears to be increasing in many parts of the world. A complete profile of salivary proteins using proteomic approaches is necessary for identifying specific potential protein biomarkers for oral cancer.

The present study involves screening for cancerous protein marker in South Indian oral cancer patient using whole saliva as a tool. Saliva samples were collected from 40 healthy controls and 17 patient samples, which includes 11 smoking and 6 non-smoking oral cancer patients. Saliva sample collection and processing protocol was standardized. A comparative study of male and female controls with patient samples was carried out. Two dimensional proteome pattern of whole saliva for control and patient sample was performed and analysed. Development of technique to detect target protein of interest at nanoscale using immunoassay is under standardization. The results led to the above findings will be presented and their implications will be discussed.

PP-07

MUCOADHESIVE PLGA NANOPARTICLES FOR NASAL IMMUNIZATION AGAINST HEPATITIS B

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In this study, HBsAg loaded PLGA nanoparticles were prepared and coated with chitosan and tri-methyl chitosan (TMC) to evaluate the effect of coating material for nasal vaccine delivery. The developed formulations were characterized for size, zeta potential, entrapment efficiency and mucin adsorption ability. It was observed that PLGA nanoparticles demonstrated negative zeta potential. However, coated nanoparticles showed high positive zeta potential. Results indicated that TMC nanoparticles demonstrated substantially high mucin adsorption as compared to chitosan coated nanoparticles and PLGA nanoparticles. The coated and uncoated nanoparticles showed deposition in NALT under fluorescence microscopy. The coated and uncoated nanoparticles were then administered intranasally to mice immune-adjuvant effect was determined on the basis of specific antibody titer observed in serum and secretions using ELISA. It was observed that coated particles showed a markedly increased anti-HBsAg titer as compared to plain PLGA nanoparticles but the results were more pronounced with the TMC coated PLGA nanoparticles.

PP-08

ROLE OF CURVATURE IN PEG-MEDIATED FUSION BETWEEN DIFFERENTLY CURVED MEMBRANES

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During neurotransmitter release, anchoring of curved synaptic vesicles takes place with the un-curved pre-synaptic plasma membrane. After the appropriate, and as yet poorly understood, trigger, this leads to fusion of two lipid bilayers and release of neurotransmitters. Our previous efforts to model this system have employed two populations of highly curved vesicles, while other have used two populations of vesicles having ill-defined but clearly much lower curvature. In preparation for examining the effect of mismatched curvature on fusion of SNARE-protein-linked vesicles, we have examined this issue in poly(ethylene glycol) (PEG)-triggered fusion of protein-free vesicles. Highly curved (23nm diameter) vesicles (SUV) were prepared by sonication from a mixture of DOPC/DOPE/sphingomeylin/DOPS/cholesterol (32/25/15/8/20). Un-curved vesicles 120nm; LUV) were prepared by multiple extrusions through 100nm polycarbonate filters. Fusion of SUV with LUV was optimal at 7wt% PEG, with which all detailed kinetic studies were performed. Not surprisingly, LUV-LUV fusion was barely detectable, while SUV-SUV fusion was reasonably efficient (~7% of ideal content mixing at saturation, lipid mixing being ~35% at saturation). Remarkably, SUV-LUV fusion was decidedly more efficient (~40% of ideal content mixing at saturation; lipid mixing ~90% at saturation). SUV-LUV fusion was enhanced by a compressive osmotic gradient. These and other observations lead us to conclude that 1] curvature of one of two membranes is sufficient to promote efficient fusion and, 2] is necessary to achieve highly efficient fusion at realistic membrane-membrane distances; and 3] mismatched membrane curvature may promote formation of the initial fusion intermediate.

PP-09

APPLICATION OF ELECTROSPUN NANOFIBERS FOR PACKAGING AND STORAGE OF BIOCIDAL ENZYMES.

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Electrospun nanoclay nylon composite nanomembranes coated on polypropylene sheets were used for packaging biocidal enzymes namely chitinase, endochitinase, N-acetylglucosaminidase, protease and β-1,3 glucanase obtained from *Myrothecium verrucaria*. Comparison of activities for powdered and liquid form of enzymes was performed between enzymes packed in fiber coated and control polypropylene packages, at regular intervals. Better retention of enzyme activity was observed within fiber coated package at both 25°C and 37°C. Also, percentage difference of activities between control and test was more at 37°C, which makes the fiber coated packages suitable for storage of biocides at higher temperature.

PP-10

AN INVIVO GENOTOXICITY ASSESSMENT OF SILVER NANOPARTICLES IN RAT BONEMARROW BY CHROMOSOMAL ABERRATION ANALYSIS AND MICRONUCLEUS ASSAY

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Silver nanoparticles (Ag NPs) are being used increasingly in wound dressings, catheters and various household products due to their antimicrobial activity. Despite the increasing industrial use of silver nanoparticles data on their genotoxicity is scanty. Hence the objective of this investigation was to assess the potential invivo genotoxicity of 25 and 35nm Silver Nanoparticles and their bulk material (AgNO3) in female albino Wistar rats. In the present study, the rats were administered orally with the doses of 500, 1000, 2000mg/kg of Ag NPs (25,35nm) and 75,150,300mg/kg of their bulk AgNo3 respectively. The control group was treated with Double Distilled water-Tween 80 mixtures. A known mutagen, cyclophophamide at a dose of 40mg/kg bw was used for the positive control group and given as a single intraperitoneal (i.p) dose. The results of Chromosomal aberration analysis revealed that all experimental groups of Ag-25, Ag-35nm (500, 1000, 2000mg/kg) and bulk (AgNO3) (75,150,300mg/kg) did not cause any significant genotoxicity at both the sampling times (18 and 24hrs) in comparison with the control. Similarly, with micronucleus test, AgNPs and their bulk did not induce significant increase in the frequency of Micronucleated Polychromatic Erythrocytes compared to the control groups at both treatment periods (30 and 40hrs) ($P > 0.05$). Our findings suggest that AgNPs and AgNO3-bulk did not cause size and dose dependent genotoxicity compared to control groups.

PP-11

GENOTOXICOLOGICAL EFFECTS OF IRON OXIDE (Fe_3O_4) NANOMATERIAL IN RATS

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Nanomaterials sizes in between 1 and 100 nanometre, are extensively used in electronics, medicine, textiles, food industries, biomedicine such as drug delivery, imaging, diagnostics etc. Uses of nanomaterials are increasing day by day; humans are most likely to be exposed occupationally or via consumer products and the environment. Iron oxide (Fe_3O_4) nanomaterials have lots of industrial and biomedical applications. So far data of toxicity of Iron oxide nanomaterials are limited.

The aim of this study was to assess the genotoxicity of Iron oxide nanomaterials (Fe_3O_4 -30nm) in female wistar rats. Characterization of Fe_3O_4-30nm was done with transmission electron microscopy (TEM), dynamic light scattering (DLS), laser Doppler velocimetry (LDV) and surface area analysis prior to use in the study. The rats were treated orally with the doses of 500, 1000, 2000mg/kg bw of Fe_3O_4-30nm by the comet assay in peripheral blood cells, micronucleus test (MNT) and chromosomal aberration (CA) assay in bone marrow cells. The results of the comet assay, MNT, CA assay were expressed as percentage of tail DNA (% tail DNA) migration in peripheral blood cells at 4, 24, 48 & 72h, frequency of micronucleated polychromatic erythrocytes (MN-PCEs) at 30&48h and frequencies of chromosomal aberrations (CAs) at 18 &24h time intervals respectively.

The results showed an increase in the % tail DNA, frequency of MN-PCEs and the frequencies of CAs but there no statistical significance ($p>0.05$) was found in comparison to control (deionized water). Cyclophosphamide (40mg/kg bw) used as a positive control showed statistically significant ($p<0.001$) increase in the peripheral blood as well as bone marrow cells. It can be concluded from the results that Fe_3O_4 was not genotoxic at the doses tested.

ANTI-MICROBIAL CHARACTERISTICS OF CARBON NANOPARTICLES PREPARED FROM LAMP SOOT

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Soot from the burning of butter and mustard oil in a lamp with a cotton wick was collected on a brass plate and dispersed in water and carbon tetrachloride as naked, and as Gum Arabic (GA, a anionic polyelectrolyte)-coated nanoparticles in water. The physiological effect of inhaled carbon nanoparticles (CNPs) and tubes (CNT), emanating from fossil fuel powered automobiles, on pulmonary activity raises health related issues and raised serious questions about the applicability of CNPs and CNTs in general, and *in vivo* applications in particular, *when the size decides cytotoxicity.* Nanoparticle characterization is necessary to establish understanding and control of nanoparticle synthesis and applications. Characterization was done by using a variety of different techniques like Transition Electron Microscopy [TEM,], Dynamic Light scattering[DLS]. They have anti-bacterial activities on gram-negative bacterial colonies. The anti-microbial activities in terms of growth inhibition for the carbon nanoparticles against *E.coli* were assayed using dilution Method, and Agar-Disc Assay. We have shown the effect of CNT on the genomic level of *E.coli*. The amount of degradation of genomic DNA was directly dependant on time kinetics.

Keywords: Carbon nanopaticles, Cytotoxicity, E.coli, anti-microbial

PP-13

DESIGN OF NOVEL NON-VIRAL VECTOR FOR GENE DELIVERY: PREPARATION, CHARACTERIZATION AND *IN-VITRO* EXPRESSION OF A VECTOR FOR INSULIN LIKE GROWTH FACTOR BINDING PROTEIN4 (IGFBP4)

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Poly(ethylene glycol) (PEG)-modified gelatin nanoparticles were synthesized by reacting Type-B gelatin with PEG by pH and temperature controlled ethanol-water solvent displacement technique, and were characterized for mean size, size distribution, and surface morphology. Electron Microscopy for morphological assessment was used to confirm the surface presence of PEG chains. For Proof-of Concept studies, after preparation of the vehicle, plasmid containing the GFP gene (a fluorophore) as a transfection marker for visualization was constructed. GFP gene was stably transfected in B16F10 melanoma cells, the transfection efficiency was ~15-20%, comparable with the standard lipofectamine method. Mice were challenged subcutaneously with 1×10^5 transfected B16.F10 cells. Tumor growth was monitored for at least 3 weeks after challenge. The tumour was excised aseptically and sliced and the cells plated in a six-well plate. Photographs clearly show that the GFP transfected cells had successfully incorporated in the tumour.

Insulin-like growth factors (IGFs) have mitogenic and antiapoptotic properties and have been implicated in the development of lung cancer. The effects of IGFs are modulated by insulin-like growth factor binding proteins (IGFBPs). IGFBP-4 is a unique protein and it consistently inhibits several cancer cells *in vivo* and *in vitro*. Its inhibitory action has been shown *in vivo* in prostate and colon. It is secreted by all colon cancer cells but its presence in lung cancer has not been reported. The protein itself does not prevent the formation of cancer, but may reduce the growth of cancer and act as an apoptotic factor. This study proposes to explore the effects of IGFBP-4 on A549 lung cancer cells in prevention of development of cancer *in vitro* as well as *in vivo*.

Key words: non-viral vector, (PEG)-modified gelatin nanoparticles, gene delivery, GFP gene, insulin like growth factor binding protein4 (IGFBP4), A 549 Lung carcinoma.

PP-14

MAGNETITE-SILICA NANOCOMPOSITES FOR BIOLOGICAL APPLICATIONS: SYNTHESIS AND CHARACTERIZATION

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The unique chemical and physical properties of nanoparticles present a highly attractive platform for a diverse array of biological applications. The surface and core properties of these systems can be engineered for individual and multimodal applications, including biomolecular recognition, therapeutic delivery, biosensing, and bioimaging.

Nanoparticles have already been used for a wide range of applications both in vitro and in vivo. Some of the properties that make nanoparticles efficient for these applications are their high surface to volume ratio, size dependent electrical, optical properties. In addition there are some nanoparticles that exhibit specific properties like fluorescence, ability to bind biomolecules, and with magnetic property, biocompatibility which makes nanoparticles a potential tool for biological applications like drug delivery, contrast agents and biosensing

In the present work nanocomposites, which combine one or more separate components in order to derive the best properties of each component are being studied. The biocompatible property of silica (SiO_2) nanoparticles used for surface coating which makes our nano composites amenable for further engineering making them suitable for biological applications and also prevent agglomeration of the magnetite nanoparticles.

This paper addresses the synthesis of magnetic silica nanoparticles which are biocompatible, shows good ability to bind with biomolecules (like enzymes), catalysis of electro chemical reaction, enhancement of electron transfer between the electrode surface and protein and studies by using different characterization techniques like X-Ray diffractometry (XRD), Fourier Transform Infrared Spectroscopy(FT-IR), Transmission Electron Microscopy (TEM).

BIOINSPIRED SILICIFICATION OF MONODISPERSE MESOPOROUS SILICA NANOSPHERES FOR SUSTAINED AND CONTROLLED DRUG DELIVERY

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A critical challenge in the field of biomedical science is to develop new delivery vehicles for variety of drugs. Conventional dosage forms for systemic oral delivery are predominantly tablets, capsules, powders, granules, solutions, emulsions and suspensions. The inherent problem with these dosage forms is the release of drugs, which involves an initial burst release effect. Among the various drug delivery systems like liposomes, polymeric capsules, hydrogels and other organic carriers, which suffer premature degradation, mesoporous silica based materials have been found to be potential and promising alternative. Silica based material has been explored as drug delivery devices due to their attractive properties such as high surface area, tunable pore sizes, high pore volume and presence of silanol containing surface which can be functionalized to control better loading and release of drug molecules. Importantly, silica is nontoxic and biocompatibile, which are the two prerequisite for any matrix to be used for drug delivery. Here we demonstrate that monodisperse mesoporous nanospheres (MMSN) obtained via a bio-inspired silicification route under ambient conditions exhibits efficient encapsulation of ibuprofen, a nonsteroidal anti-inflammatory drug into its mesopores. Sustained and controlled release of the drug is in turn governed by the surface charge of MMSN. Unlike the other methods, which require sequential steps for surface functionalization to manipulate the surface charge, in the present case the surface functionality is acquired during the bio-silicification process without the requirement of further modification. The presence of polyamine in the silica matrix, which acts as pH responsive gates results in controlled release of the drug.

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SILICA NANOPARTICLE-ASSEMBLED HIERARCHICALLY ORDERED MICROCAPSULES FOR REMOVAL OF OXYANION CONTAMINANTS FROM WATER

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Arsenic and chromium contamination of groundwater is now a worldwide problem. High arsenic concentrations have been reported from all parts of the world especially from Bangladesh and West Bengal in India.[1,2] Long-term exposure of these species cause lung, bladder, and kidney cancer as well as neurological disorders, muscular weakness and nausea. These contaminating species can exist in nature as tetrahedral oxyanions ($HAsO_4^{2-}$, $H_2AsO_4^-$, $HCrO_4^-$, CrO_4^{2-}). Selective removal of these oxyanions from drinking water is now a challenging task for scientists. So far, ion-exchange resin, alumina, phosphate, zeolite, activated carbon, mesoporous silica have been used as adsorbents, but their selectivity and capacity is less. In this contest we have employed hierarchically ordered microcapsules in which, multivalent anion-polyamine based supramolecular aggregates were first formed and then silica based nanoparticles were deposited around the aggregates to form a multilayer thick shell.[3] We have synthesized several microcapsules with variable composition, size, shell thickness by choosing different anions, polyamines and nanoparticles. While the presence of amine groups in the microcapsules can result in adsorbing the contaminant oxyanions, the silica shell consisting of silica nanoparticles can provide the opportunity to modify the surface and porosity besides the mechanical strength. Performance of thus prepared microcapsules in removal of these oxyanions from water was evaluated. The results show that the amine groups present in microcapsules are accessible for adsorption of the oxyanions. Further, we have synthesized magnetic microcapsules by using ferrite-based nanoparticles to improve the adsorption and to impart the magnetic separation.

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PP-17

IN VITRO CYTOTOXICITY OF NANOPARTICLES MANUFACTURED FROM TOTAL SUSPENDED PARTICULATE MATTER PREVALENT IN UNORGANIZED BONE-BASED INDUSTRIAL UNITS

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Our recent industrial hygiene studies in unorganized bone-based industrial units manufacturing ornamental and decorative products showed prevalence of TSPM (total suspended particulate matter), PM_{10} (particle equal or less than 10 micron) and $PM_{2.5}$ (particle equal or less than 2.5 micron) to which workers are exposed occupationally. It was also observed that hemolytic and cytotoxic activities of occupational dust was correlated with size of the particles. Now we are reporting hemolytic and cytotoxicity activities of nanoparticles using red blood cells (RBC) and hepatocytes isolated from rat. Nanoparticles (NP) were manufactured from TSPM with the help of planatory bal mill, PM-100 and NP were incubated with RBC to study haemolysis whereas hepatocytes to study cell viability, leakage of LDH (lactate dehydrogenase), GSH (reduced glutathione) as well as LPO (lipid peroxidation), H_2O_2 (hydrogen peroxide) and NO (nitric oxide) in a concentration (25-200 µg/ml) dependent manner. At 200 µg/ml concentration, TSPM caused 15% haemolysis whereas NP 52.5%. Cytotoxicity produced by TSPM and NP in concentrations 25-200 µg/ml were in the range of 5-9% and 20-36%, respectively. Comparatively, release of LDH, a marker of membrane damage, was significantly higher by 3.2-fold and GSH by 3.8-fold due to NP at 200 µg/ml concentration. LPO profiles were enhanced by 15-27% and 64-125% at concentrations 25-200 µg/ml by TSPM and NP, respectively. Likewise, NO production enhanced at 25-200 µg/ml by 31-50 % and 148-198 % by TSPM and NP respectively. H_2O_2 production was similarly enhanced by 68-112 % and 310-447 % at 25-100 µg/ml by TSPM and NP respectively. Briefly, biological reactivity of NP, in comparision with TSPM, is enhanced by 3.2-4.4-fold, assessed on the basis of different markers of cytotoxicity. Financial grants from Council of Science and Technology, U.P. is gratefully acknowledged.

PP-18

GREEN SYNTHESIS OF GOLD NANOPARTICLES USING THERAPEUTICALLY ACTIVE ENZYME

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The objective was synthesis, evaluation of gold nanoparticles (AuNps) using a therapeutically active enzyme (TAE) under different conditions and retention of therapeutic activity of the enzyme. AuNps were synthesized under condition 1- at 75^0C in Millipore® water (pH 6.5), condition 2- using phosphate buffer (pH 7.5) at 25^0C and condition 3- using pH 12 at 25^0C. UV spectroscopy confirmed the formation of AuNps under all three conditions, the surface plasmon band (SPB) being exhibited at 545nm, 538 nm and 521 nm respectively. TEM revealed oblong shape of condition 1 AuNps with size 33±5.01 nm, spherical shape of condition 2 and 3 AuNps with size 27±7.5 nm and 13±7.5 nm respectively. Zeta potential of AuNps was –1.65 mV, - 28 mV and – 23.3 mV respectively. XRD pattern of the AuNps displayed prominent *Bragg* reflection peaks, indexed at 111, 200, 220 and 311 on the basis of gold's structure. FTIR study indicated shift in wavenumber of amide bands in AuNps suggesting involvement of these groups in the synthesis. In pH stability study, the redispersed synthesized AuNps were more stable at pH 8 to 10 than at pH 2 to 4 for 24 hours. On storage for one month, AuNps produced under conditions 2 and 3 did not exhibit shift in the SPB as compared to those prepared under condition 1, indicating suitability of conditions 2 and 3 to produce stable AuNps. Further the condition 3 AuNps retained enzymatic activity as revealed by casein agar plate method. In-vivo studies conducted in wistar rats revealed enhancement of anti-inflammatory activity of these AuNps as compared to pure enzyme. In conclusion, temperature and pH are important for synthesis of highly stable and biocompatible AuNps with respect retention of the therapeutic activity of the enzyme.

PP-19

ACUTE ORAL TOXICITY STUDY OF ALUMINIUM OXIDE NANOMATERIAL IN ALBINO RATS WITH SPECIAL EMPHASIS ON BIOCHEMICAL ASSAYS

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The acute oral toxicity study in albino Wistar female rats was conducted for Aluminium oxide-30nm nanomaterial. The studies included the observation of mortality, toxic sign and symptom, changes in body weight, feed intake and modulation in antioxidant enzymes of some of the vital organs of the control and treated rats. Initially, the sighting study at 5, 50, 300 mg/kg dose levels in each rat was done. Since, no mortality and toxic symptoms were noted in any dose level in sighting study and hence, the main study was completed in group of five rats by orally treated 2000mg/kg Aluminium oxide 30nm. The test rats were kept for 14 days, during this period, changes in body weights, feed intake, mortality, signs and symptoms if any were noted. On 14th day, the animals were sacrificed; liver, kidney, brain and heart tissues were dissected out. Malondialdehyde (MDA), reduced glutathione (GSH) level and glutathione S-transferase (GST) activity were determined. Aluminium oxide 30nm treatment caused an increased in MDA level and decreased the GST activity and GSH levels in treated tissues. The study suggests that Aluminium oxide nanomaterial treatment caused oxidative stress condition in liver, kidney, brain and heart tissues by enhancing the lipid peroxidation level and depleting the antioxidant defense system in the tested rat.

PP-20

ACUTE ORAL TOXICITY EFFECTS OF IRON OXIDE NANOMATERIALS IN ALBINO WISTAR RATS: ROLE OF OXIDATIVE STRESS

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Engineered magnetic nanoparticles (MNPs) are widely used in medicine because they can be simultaneously functionalized and guided by a magnetic field. Use of MNPs has advanced magnetic resonance imaging (MRI) guided drug and gene delivery, cell replacement therapy, imaging of cancer-specific gene delivery, magnetic hyperthermia in cancer therapy, tissue engineering, cell tracking and bio-separation. However, evidence suggests that certain properties of nanomaterials (NM) (e.g., enhanced reactive area, ability to cross cell and tissue barriers, resistance to biodegradation) amplify their cytotoxic potential relative to their molecular or bulk counterparts. Several mechanisms have been proposed to explain the adverse health effects of NM. Among these, production of reactive oxygen species (ROS) and the generation of oxidative stress (OS) have received the most attention. Excessive production of ROS or a weakening of antioxidant defense could lead to OS. Since OS is a 3-tier paradigm of nanotoxicity, it manifests in the activation of ROS (tier I), followed by a pro-inflammatory response (tier II) and DNA damage leading to cellular apoptosis and mutagenesis (tier III). The aim of the current study was to investigate the mechanisms by which MNPs (Fe_2O_3, 10nm & bulk) exert their deleterious effects (if any), through an ability to generate ROS. The study was carried out according to OECD 420 guidelines where the rats were dosed with 2000 mg/kg body weight of MNP's. After 14 days, rats were humanely sacrificed. Serum, liver, kidney, heart and brain were collected for biochemical estimations. Malondialdehyde-a lipid peroxidation end product, reduced glutathione-a non-enzymatic antioxidant, catalase and Glutathione S transferase - enzymatic antioxidants were assayed in all the tissue supernatants. The results obtained will be discussed.

PP-21

TOXICOLOGICAL EVALUATION OF IRON OXIDE NANOMATERIAL BY SUBACUTE (28 DAY) STUDY

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Iron oxide nanomaterials (NMs) have been of great interest, not only in fundamental properties caused by their multivalent oxidation states but also by the abundant polymorphism and mutual polymorphous changes in nanophase. They find application in nanotechnology related fields including high density magnetic recording media, sensors, catalysts, environmental catalysis, biomedical imaging, magnetic tracking, targeted drug delivery and clinical uses etc. It appears that the chemical nature and the physicochemical reactions occurring at the nanoparticle/cell interface are the key to the biological effects. In particular, nanoparticles can affect biological targets through generation of reactive oxygen species (ROS) thereby inducing oxidative stress (OS). Iron, being a highly redox-active transition metal, promotes the formation of ROS via different pathways. It may possibly be due to free radical generation through Fenton and/or Haber-Weiss reactions, dissolution and release of metals, presence of structural defects, activation of the immune systems generating secondary cellular ROS and catalysis of the reduction of O_2 via electron transfer reactions. Hence it is necessary to determine the underlying mechanisms and key factors responsible for the oxidative stress induced by nanomaterials in order to properly ameliorate risk studies. Hence in the current investigation, sub acute toxic effects of iron oxide NMs and bulk were determined by treating daily 30 and 300 mg/kg body weight orally to albino Wistar female rats as per OECD guidelines. The kinetic study end points used were Reduced glutathione, Glutathione S-transferase, Catalase and rate of lipid peroxidation as measured by levels of Malondialdehyde formed. The results obtained will be discussed.

PP-22

BIOCHEMICAL EFFECT OF IRON OXIDE (Fe_3O_4) NANOMATERIAL IN ALBINO WISTAR RATS

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Recently, nanotechnology has acquired a new dimension in medicine and healthcare, and its use in various therapeutic aspects, for example, drug delivery to chemotherapy, is increasing day by day. In addition, nanoparticles can stimulate vesicular transport to gain access into the CNS microenvironment. However, the effects of nanoparticles on biological systems should not be ignored while developing nano-based medicine as future therapy. Only a few sporadic investigations deal with the *in vivo* effects of nanoparticles on biological systems.

The biochemical changes induced by a test compound have significance in its toxicological studies, alterations in biochemical parameters before clinical signs and symptoms indicate either the safety of toxicant or its detrimental effect and these parameters can be used in predictive toxicology. Acetylcholinestrase (AChE) and different ATPases are membrane bound enzymes concerned with immediate release of energy and responsible for large part of basic metabolic and physiological activities. Therefore, in the present study these target enzymes were monitored in rats exposed to sub-acute Iron oxide (Fe_3O_4) <50 nm size for 21 days. Lower dose of Fe_3O_4 NPs activated RBC AChE activity, whereas higher dose inhibited insignificantly in the exposed animals. Brain AChE significantly inhibited by both the lower and higher doses of Fe_3O_4 showing its effect on nerve transmission. Total and Mg^{2+} ATPases were activated by both the doses in comparison to control, Na^{+}-K^{+} and Ca^{2+} ATPases were inhibited by lower and higher doses. Therefore, our study indicated that Fe_3O_4 NPs caused alterations showing toxic effects in the exposed animals.

PP-23

TOXICOLOGY OF NANO PARTICLES

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Manufactured products using nanoparticles has undergone explosive growth over the past 20 years. However, very few rigorous studies have provided information concerning how nanoparticles interact with the environment. Nanostructures of different sizes, shapes and material properties have many applications in biomedical imaging, clinical diagnostics and therapeutics. In spite of what has been investigated so far, a complete understanding of how cells interact with nanostructures of well-defined sizes, at the molecular level, remains poorly understood. The cytokines produced by immune cells help to activate other areas of the immune system (T cells) and are the first line of defense against various adverse physiological conditions. In the present study immune cells will be used as model system to examine the interaction of engineered nanomaterials with the immune system. The interactions will show the activation of various cytokines involved in immune cell responses. Secondly the immune cells will be used to show how the engineered biofunctionalized nanomaterials are able to modulate the production of cytokines. The fundamental understanding of nanomaterial-immune interaction will assist in the design of nanoscale delivery and therapeutic systems and provide insights into nanotoxicity.

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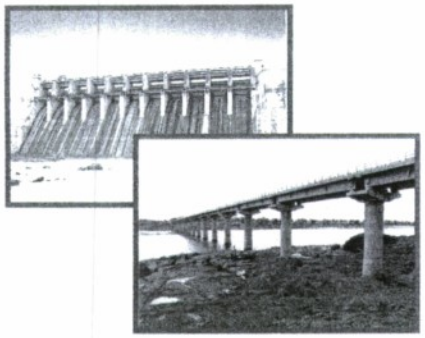

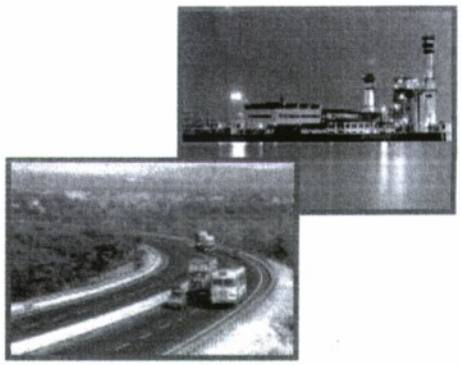

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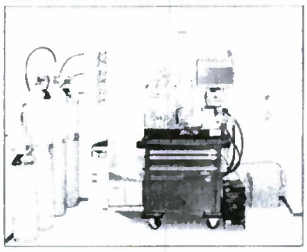

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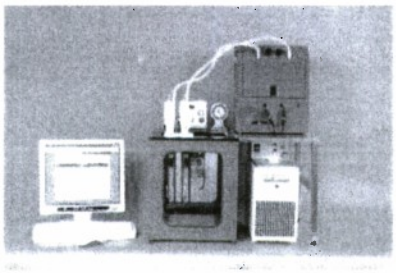

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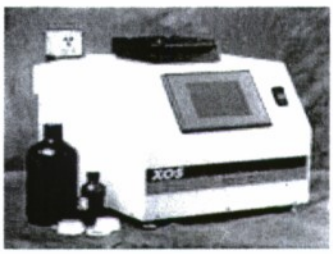

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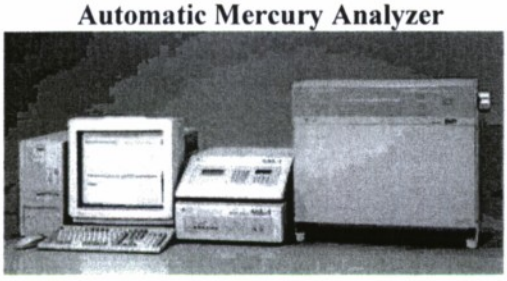

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